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A Weekly Journal Devoted to Industrial and Engineering Chemistry

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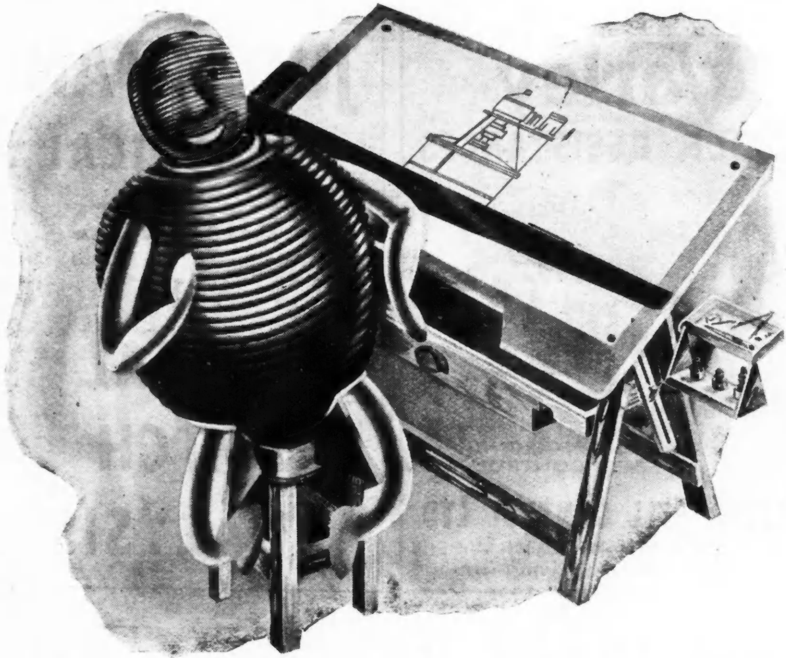

The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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GLASGOW: 116 Hope Street (Central 3970) BIRMINGHAM Daimler House, Paradise Street (Midland 0784-5)

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Instruments and Laboratories

A RECENT survey made by the Federation of British Industries, to which we made reference last week, has shown that a large number of firms from whom information has been received intend to extend their research staff by no less than 25 per cent., and their laboratory space by more than 2,000,000 sq. ft. That is a remarkable fact, and suggests a bright future for the British instrument industry. Laboratory fitting and equipment is a matter upon which there is divergence of opinion. It is said, and with every justification, that it is impossible to guarantee results by setting up magnificent laboratories complete with every type of modern equipment. The men who work in the laboratories are more important than the material things with which they work. That is entirely true, as has been shown by the many outstanding results obtained by men of genius working under the most adverse conditions. Such men are urged by their overwhelming genius to heights to which most of us cannot aspire. Their genius is such, that in spite of inadequate equipment they can obtain results. They can invent and make their own equipment.

The fact remains, nevertheless, that the great bulk of scientific work to-day consists in making exact measurement of chemical composition or of physical properties, which measurements can be made only by means of standard apparatus manufactured with a high degree of precision. The use of scientific instruments during the recent war has reached heights never before known. Our instrument manufacturers and technologists have designed and made instruments of surpassing excellence, and it is not too much to say that those instruments have played an outstanding part in giving us the victory. Mankind, it was said in 1916, had packed its tents and was on the march. To-day, mankind is again on the march. Science is on the march. That march can be guided to its destination only by instruments. It is of the first importance to recognise that the development of new processes, and of new industries, necessitates new types of measuring instruments and of scientific apparatus. Our instrument-makers are continually being asked to design for new uses, and they are not found wanting.

The use that is made of instruments in war time prompts us to believe that nations that cannot keep the peace, like Germany and Japan, should not be allowed to set up an instrument industry again.

On Other Pages

The warlike potential of a country powerful in the manufacture of instruments is considerable and, conversely, the power to make war is drastically curtailed by the lack of instruments. No aeroplane can take the air, no submarine submerge in the sea, no searchlight illumine, nor even a gun be fired without scientific apparatus, while the newer developments of radar and many another war-time invention are even more potent. It is known that Germany had a vast production of instruments before the war. In many lines her production was 20 times that of this country. Vast numbers of skilled workers were trained in the German industry and under cover of her great export trade in instruments Germany built up a monopoly through which she effectually prevented the countries that she was to overrun from supplying their own instruments or from training their own men. It is a fine tribute to the workers in the British instrument industry that in spite of all handicaps—and they were very great—they beat Germany at her own game and produced, under the stress of war, instruments at which the world marvelled and is still marvelling.

The need for assisting the continued development of our instrument industry is still paramount. It is one of those highly skilled manufactures which cannot be lightly undertaken by any Tom, Dick or Harry. Instruments are the sort of export that will be of most value to the country, since the quantity of raw materials is a minimum, while the labour and brains that go to their manufacture is a maximum. It may well be that the instrument industry should organise itself so as to avoid unnecessary competition. It is foolish for several makers to manufacture precisely similar apparatus, since this prevents the application of mass production. As an instrument becomes known it may well be that its sales in the export market will depend upon price. Mass-production methods enable production per man to be increased, and, therefore, the price to be reduced.

A prominent instrument-maker has said that the industry must ensure that as much as possible of the expenditure of money on research and on the development of new instruments must be cancelled by improvements in methods of manufacture and by the elimination of uneconomic competition. He gave two examples: "A friend recently took the trouble to investigate the sources of supply of Wheatstone bridges. He found that there were about 1000 to 2000 sold annually and that, approximately, 100 firms made them. The annual sale of Redwood viscometers is about 144, and there are about 8 people making them. In another industry, making a material used in every laboratory, annual sales of under £8000 were shared by three different firms, making four different grades of quality. The value mentioned was made up of no less than 300 different shapes and sizes." This suggests that some reorganisation is desirable, coupled with standardisation of the better known and well-established equipment. It may well be that this necessary step has been carried out, but if so, there is no public record of it, so far as we are aware.

The users of instruments have a duty to their colleagues, the manufacturers. It is, to buy British. There are certain instruments which must be imported, because they are not made here, such as the electron microscope. In time, however, most instruments can be and will be made in this country. Wherever there is a British instrument, it should be bought by British users. If the British instrument, for any reason, does not fill the bill, the remedy is not to discard it and buy foreign, but to ask the instrument-maker to improve his instrument, giving him all possible assistance and advice.

Finally, a word about industrial instruments—not those used in laboratories, but those used on the works for measuring or recording. It is in this field that complaints are most frequently heard. The allegation is that the instrument soon becomes incorrect or gives up the ghost altogether. Boiler-house instruments, often used by the unitiated, probably head the list of the supposedly unreliable. The answer every time is *maintenance*. Unless an instrument is well maintained it cannot continue to function. Instrument-makers will generally undertake maintenance of their instruments for a small annual fee and unless the works is big enough to have an expert to look after all the instruments on the works, it is very desirable to take advantage of this service. Another very general cause of dissatisfaction is that the user puts in instruments without consulting the maker. The maker must be taken completely into the user's confidence. He should be called in before the instrument is ordered and

allowed to supervise its installation. The most complete frankness should exist between the instrument-maker and his industrial client. If these simple precautions are taken, there is very little doubt that at least nine-tenths of the complaints that are now heard will cease. Instruments are the key to efficient industrial operation. They are the eyes and ears of the operators. An aeroplane is flown blind by the use of instruments. "How wonderful!" we say. But industrial plant is run blind by instruments. That is often the only way. If the instruments are not looked after, how can the works be efficient?

NOTES AND COMMENTS

Total Plan for Steel

IF any confirmation were needed of the Government's determination to legislate rather than to govern, it has been given by the extremely woolly statement, made by the Minister of Supply last week, on the future of the iron and steel industry. After a somewhat patronising reference to the reports received from the British Iron and Steel Federation and the Joint Iron Council, the ukase was enunciated that "a large measure of public ownership"—whatever that may mean—was necessary for this industry, in view of its "importance in the national economy." The reports mentioned were prepared by experts—by experts in an industry with a magnificent record of production in war and peace—and though the Federation's report envisaged the expenditure of £168 million on the development and modernisation of the industry over the next five to seven years, it is dismissed as simply "an important contribution to the planned development of this basic industry." If this report is no more than an "important contribution" to the plan, we should like to know what the total plan is, and who is responsible for the planning. Mr. Wilmot does not say—for sufficiently obvious reasons—but he proposes to establish a Control Board to help him put into effect some scheme or other of public ownership and advise him "in the preparation of the scheme of nationalisation."

Mr. Churchill's Attack

MEANWHILE, the industry is left guessing what is to be its ultimate fate. Apologists excuse this vagueness by citing the complexity of the industry, adducing the uncertainty as to how many of its various parts can reasonably be taken into "public ownership," Mr. Churchill, in a vigorous attack on the plan, stigmated it as a "singularly questionable and thoroughly disreputable performance," indeed "a pure political ramp"; and the Prime Minister's reluctance to promise a debate on so important a subject lends weight to Mr. Churchill's suspicions. We cannot help feeling that the whole business savours of the dictatorial; the Government seems drunk with a heavy draught of mandate, debate appearing to them as an unnecessary embroidery. We are still nominally a parliamentary democracy, however, and this sort of thing will not do. Moreover, to come down to brass tacks, nothing has so far been said about what this scheme is going to cost the taxpayer; who, we should like to know, is going to put up £168 million for development now? It will be noted that the chemical industry is becoming ever more closely beleaguered; it is nearly concerned with the ancillary processes of both the coal and the steel industries, and one day it may wake up to find itself being groomed for "public ownership," with a Control Board working out the details, while the American, and probably the German, chemical industries get away with the export trade.

Scottish Industrial Chemistry

THERE has lately been a wave of complaint in the Scottish Press, and elsewhere, that there is an insufficient number of openings in Scottish industry to accommodate the excellently-trained chemists turned out by the universities and technical colleges of Scotland. Most recently, a correspondent of the Scotsman, signing himself "Another Industrial Chemist," hits the nail on the head in the following sentences:

"The fact is," he says, "that Scottish universities and technical colleges turn out more scientific chemists than Scotland can at present absorb. The number of fully qualified chemists in Scotland (in industry, presumably) is at a round figure 1000, and the universities turn out far more than

enough graduates to replace the annual wastage, with the result that many find employment outside Scotland. What is the solution? Firstly, more industrialists should be forthcoming who are willing to risk their money and energy in founding new light scientific industries in Scotland. Secondly, greater emphasis should be laid on the training of more chemical engineers, of whom there is a shortage in Britain compared with America, and who seem likely to play an increasingly important rôle in the expansion and improvement of our industries."

Here is an opportunity for further development in the craft and science of chemical engineering. The foreseeing generosity of certain important industrial concerns has contributed largely to the progress of chemical engineering in the North of England; an extension of this policy to the universities and technical colleges north of the Tweed would be an excellent insurance against the danger of a renewed creation of " depressed " areas in industrial Scotland.

More Money on Research

It is encouraging to note that in at least one direction the Government at all events *plans* to spend more money on research during the coming year. The estimated cost of the Department of Scientific and Industrial Research in 1946-7 has been given at £2,390,934, which exceeds the figure for 1945-6 by £1,000,000. The estimated actual expenditure is £2,711,567, but it is expected that receipts will bring in £320,633. These arise mainly from charges for work undertaken for other Government departments and outside bodies. Also included are patent fees and revenue from the sale of small quantities of by-products obtained at the research stations in the course of investigations. A point on which those concerned deserve praise is that the estimated cost of general headquarters administration (excluding the Intelligence Division and the British Commonwealth Scientific Office) amounts only to 2.27 per cent. of the gross total.

How the D.S.I.R. Helps

The layman who is ignorant of the good work done by the D.S.I.R. may wonder whether the money it costs is justified from the taxpayer's point of view, but actually the money is well spent. Take chemical research, for instance. Blowflies cause tens of thousands of deaths among sheep each year. Losses from these pests will be greatly reduced in future, simply because the Chemical Research Laboratory has developed a product incorporating DDT as a sheep-dip and this is now being produced industrially. Valuable help came in another direction, too. The war stopped the import of pyrites for the manufacture of sulphuric acid, but by giving advice on the extraction of pyrites from colliery refuse in this country the Fuel Research Station not only helped the country over a difficult period during the war, but is still saving shipping space and foreign currency. Altogether, the work of the Department brings in large dividends.

Dielectric Energy

Discussion on Polar Molecules

At the recent annual joint meeting of London and Home Counties Section of the Institute of Physics and the London and South-Eastern Counties of the Royal Institute of Chemistry, at the Royal Institution, a symposium and discussion on "Polar Molecules and Dielectric Problems" was held, with Dr. G. L. Riddell, F.R.I.C., in the chair.

Dr. S. Whitehead introduced the theoretical ideas associated with the behaviour of dipoles under electrical stress and showed how the original ideas of Lorenz had been modified by later workers on the subject. Mr. A. J. Maddock gave a historical résumé of the practical aspects, beginning with Siemens (1864) who first observed the heating effects of high-frequency energy, followed in 1891 by Tesla who applied the phenomenon to diathermy. Practical advances, many the subject of patents, were made in U.S.A., France, and Germany, but it was not until 1942-3 that the commercial use of dielectric heating became available for the thermo-setting of plastic resins. Because the dielectric material is heated uniformly throughout the mass and only thermal loss is suffered at the surface by air cooling, the application of high-frequency heating is now largely employed for the manufacture of laminated boards and shaped laminated pressings. It has possible fields in processes of drying, dehydration and cooking.

Mr. N. J. L. Megson gave an account of the effect of polar molecules on the constituents of plastics, and explained the changes which thermosetting and thermoplastic materials undergo when they are heated. The papers were followed by an interesting discussion.

Instruments in the Analytical Laboratory

The Past, the Present and the Future

by CECIL L. WILSON, M.Sc., Ph.D., F.R.I.C.

ANALYTICAL chemistry, always one of the main branches into which practical chemistry can be divided, has sometimes apparently suffered eclipse. Looking back in historical mood over the past 60 or 70 years, one notes that at the beginning of that period analytical chemistry, which had but recently been put on a sound and precise footing, was an honoured branch of the profession. As time passed, and as newer branches of chemistry caught the attention of chemists, the practice of analysis came to be looked on as something fixed, incapable of further radical development, and therefore as something suitable only for the chemist untuned to higher flights. This attitude was, of course, only superficial. Chemists still necessarily utilised analysis. Analysis continually threw up new and important problems. And above all, there were still a few of the great figures of chemistry who were content with the less spectacular, but none the less fundamental researches which these new problems raised.

During the last twenty—or perhaps even the last ten—years, analysis has come once more into the foreground. Inspired by the striking achievements of microchemists in the analysis of minute amounts of material, the ingenuity of the chemist has been led more and more into analytical by-ways, until at the present time, in every country, a profound interest in this branch has reawakened.

In this renaissance the instrument has played an honourable, perhaps a fundamental part. Instruments in chemical analysis are largely microchemical in function. This may be a controversial statement: the other attitude current on this point is that microchemistry is largely a matter of instruments. But argument along these lines can continue unlimited, without resolving a problem which, perhaps, really requires no resolution.

However that may be, instruments nowadays play a foremost part in the work of the modern analyst. It would be instructive to refashion an analytical laboratory of the 'eighties, side by side with its up-to-date counterpart. In those days, analysis was largely a matter of beakers and flasks. One or two instruments had already been applied to chemical problems, but their use cannot be said to have been widespread. In passing, it is worthy of note that these instruments, such as the microscope and the spectroscope (in its modern form the spectrograph), still play an important part in instrumental analysis. On the whole, a striking contrast would be apparent, one which also appears if the pages of an early edition of a standard text-book on analytical chemistry are consulted.

The instrument, then, has had an important rôle in the analytical revolution.

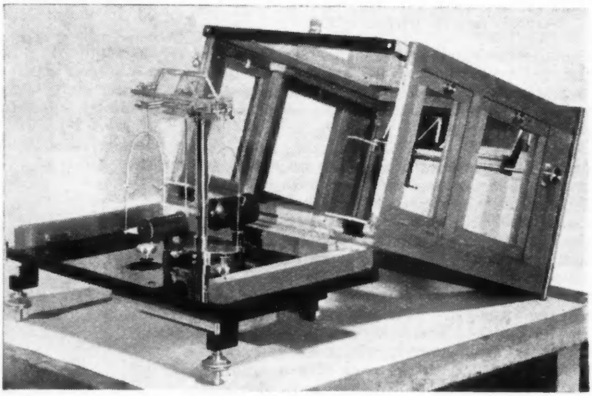


Fig. 1. A microchemical balance—Type 63 PB, by L. Oertling, Ltd.

Further consideration of the place which the instrument at present takes in analytical chemistry inevitably raises a number of important questions. In the first place, one must consider the interpretation to be placed on the term "instrument" in this connection. That this is by no means an easy problem has already been emphasised. Müller (*Ind. Eng. Chem., Anal. Ed.*, 1941, *13*, 667), in a symposium on Instrumental Methods of Chemical Analysis, proposes a rough definition by example. This can be

paraphrased as a device which, in analysis, either gives a direct answer, or at least goes some way towards cutting out the calculations normally associated with the determination of one form of matter by transformation to yet another form. This definition, in part true, nevertheless can hardly be regarded as complete. Indeed, Müller himself admits that in his subsequent discussion of instruments he has allowed himself to deviate to some extent from his definition. On consideration, one automatically thinks of the first instrument, historically and practically, of the analytical chemist—the balance. This fits into Müller's definition only if one rearranges

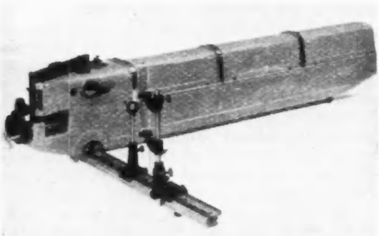


Fig. 2. Large quartz spectrograph, by Adam Hilger Ltd.

one's terms of reference considerably, since the balance, in analysis, is not an intermediate aid, but is, in most instances, a primary necessity. Yet it is surely being too rigid to exclude it from one's consideration of analytical instruments, on the ground that it does not fit into one or other narrow conception. It is probable that in this article no clearer delimiting of instruments from other analytical aids will arise, though Müller's definition will to some extent provide a means of orientation.

The second problem that arises is the query whether the instrument is necessary to the analyst. To this no equivocal answer can be returned. There is no doubt whatever that nowadays the analyst must be conversant with the uses of a number of instruments. It could be argued, although perhaps only for the dialectical delight to be obtained thereby, that analyses could, in general, be carried out quite successfully using only the balance and the simplest of apparatus. This is quite true, but is not the whole truth, since it overlooks the factor of efficiency. Efficiency, for the modern analyst, involves not only producing the correct answer, but also producing that answer in the shortest possible time. It is usually at this stage that the instrument is brought to the fore.

The older methods are important, since they form the foundation of analysis; and only by studying them can one become conversant with the true nature of the problems which analysis raises. That this is so may be supported by an examination of handbooks used for the teaching of analytical chemistry. These often ignore completely the existence of most instrumental methods, and deal instead with methods which have largely descended from the first historical period of analysis. As an aside, it may be questioned whether this method is not also faulty, though it can be excused, if not justified, on the ground that few educational institutions are sufficiently wealthy to supply themselves with a representative selection of the most important instruments, whereas they can lay in a good stock of beakers, filter funnels, and graduated glassware. This is a state of affairs which should be remedied, for it is clear that to-day the analytical laboratory, to function efficiently, must be prepared to utilise the instrument on a wide variety of occasions. So that as a corollary, it is essential that *trained* personnel, familiar with the place and function of the instrument, should be available for its operation.

The General Analytical Laboratory

The third point requiring clarification is the extent to which instrumentation *must* be applied to the analytical laboratory. To keep the scope of the discussion within reasonable limits, it can be postulated that analytical laboratories can be regarded as falling into two categories, general and special. With the latter group an article of this type cannot concern itself in any detail, since each specific case requires its own solution. But the general analytical

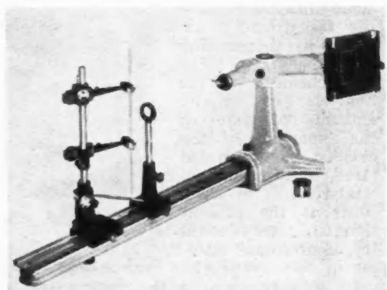


Fig. 3. Small quartz spectrograph, by Adam Hilger Ltd.

laboratory nowaday must not equip itself only for the classical analytical procedures; it must be prepared also to tackle certain problems which may be regarded as specialist, in so far as they are instrumental. It should be possible to decide on the range of instruments which should be made avail-

able in, let us say, the equipment of a new laboratory, if it is to fulfil its function adequately.

Earlier, I adverted to the inclusion of the balance as an instrument. This, it seems to me, should take first place in any consideration of this nature. The analytical balance has itself undergone radical changes corresponding roughly to those which have affected analysis. So that nowadays such a balance is expected to function more accurately *and* more efficiently, from the point of view of time, than its predecessor of 60 years ago. By suitable damping devices, and the use of projected scales, the routine use of analytical balances for long series of weighings is now a matter of extreme rapidity. The precision of analytical balances is high; and it is probable that every well-equipped analytical laboratory should possess either an analytical balance reserved exclusively for semi-micro work, or a microchemical balance such as that shown in Fig. 1—or both. Small-scale work, as its range extends, is becoming more widely practised; and while it would be incorrect to say that work should always be carried out on a small scale, it is very true that in an increasing number of instances the small-scale methods of analysis are the correct ones to apply,

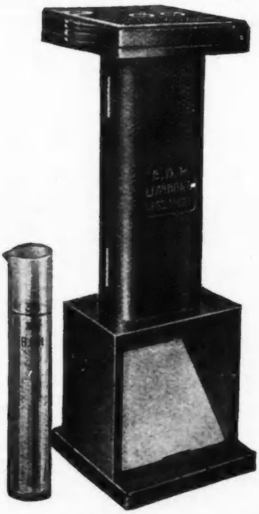


Fig. 4. Lovibond Nessleriser, closed, by The British Drug Houses, Ltd.

if only because of the time-saving to which they lead.

If the balance is *sine quâ non* in the analytical laboratory, the same is almost true of yet another instrument which traces back to the earlier classical period—the microscope. This is a point not yet properly realised on the educational side of analytical chemistry, so that too many students

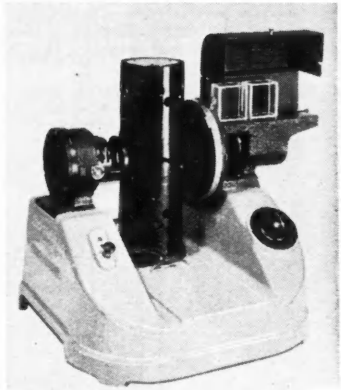


Fig. 5. Spekker photoelectric fluorimeter, by Adam Hilger Ltd.

are still considered to be trained in the fundamentals of analytical practice without ever having seen or handled a microscope.

In the choice of a suitable microscope nothing elaborate is demanded. But the instrument and its accessories must nevertheless be chosen with its purpose in mind. One does not dig a ten-acre field with a spade, except under duress. And so, while a botanical microscope is undoubtedly better than no microscope at all, its limitations would soon impress on the user the advantages of a microscope that is appropriate to the demands of analysis. As an outside requirement it would be sufficient to possess a petrological instrument fitted with a centreable rotating and mechanical stage, and with a series of lenses chosen primarily with chemical work in mind. Anything more complex would take one well into the specialist region.

Spectrographs

Third place in the list of general-purpose instruments might well be filled by the spectrograph, yet another of those with a long historical record. Most modern students gain at least a nodding acquaintance with the instrument, and most general laboratories find it an essential on occasion.

The choice of a suitable spectrograph must inevitably strike a balance between the needs of the work and the cost of the instrument. Where a wide range of problems, such as the analysis of ferrous alloys, or the use of the infra-red region, is to be anticipated, then a multi-range instrument

of the largest type, such as that shown in Fig. 2, is essential. Medium-sized instruments are available for general inorganic

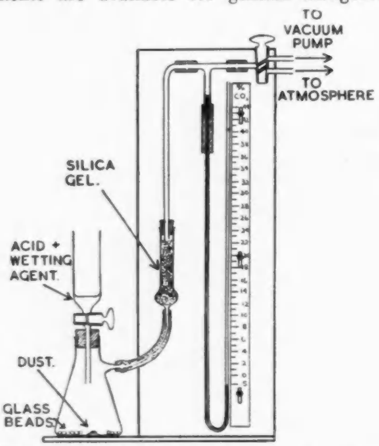


Fig. 6. "Carbolite" rapid CO_2 apparatus.

and metallurgical analysis which does not expect to deal with ferrous metals to any extent; and such instruments are usually adequate for absorption spectrography in the visible and ultra-violet regions. Very simple work, where the instrument is used primarily for preliminary surveys of problems, may often be tackled adequately by a small instrument such as that in Fig. 3.

The spectrograph still carries on its early function, that of qualitative analysis of inorganic materials, including metallurgical specimens. The field has, however, been enormously widened in the last few years by the very successful application of the instrument to quantitative problems. Both in the inorganic field, by emission spectra, and in the organic field, by absorption work, great advances in accuracy have led to application of the instrument to a variety of routine investigations. In addition, an increasing amount of attention is rightly being paid to the use of both infra-red and Raman spectra as sources of analytical data.

Colorimetric analysis has also, in simpler form, been in use by the analyst since early times. Instruments have increased its usefulness immeasurably, and the choice is exceptionally wide. Simple instruments with fixed standards, such as that of Fig. 4, or more elaborate ones on the same principle, can be widely applied. The ordinary colorimeter of the Dubosc type, which compares unknown solutions with known standard solutions, is also widely used. Finally, photoelectric measurement of the transmission of unknown solutions, by absorptiometric instruments, has made the precision independent of the operator. Developed from this last type of instrument, and coming more or less under the same head, is the photoelectric fluorimeter, portrayed in Fig. 5. While this has only recently come into use, the number of estimations in which it will prove of value will undoubtedly be increased considerably in the future.

Gas analysis, always an important part of the analytical chemist's work, has in recent years been speeded up considerably by the use of instruments. It is difficult to generalise in this field, since, as a rule, the particular type of apparatus varies according to the special problem investigated. Thus, while the apparatus aims at fulfilling the definition of an instrument given earlier, in that it produces a result in direct terms, it may vary in complexity from the relatively simple apparatus for the rapid determination of carbon dioxide, shown in Fig. 6, to the quite complex set-up for the direct determination of sulphur in steel illustrated in THE CHEMICAL AGE on January 26 (p. 113). Both of these require only about five minutes for a complete determination. In the former, a gas volume is simply read off in direct terms of percentage; in the latter, the estimation is completed by a potentiometric titration, which gives an unequivocal end-point.

Electrical Methods

A number of electrical methods available to the analyst must also be considered as general adjuncts to the laboratory. The

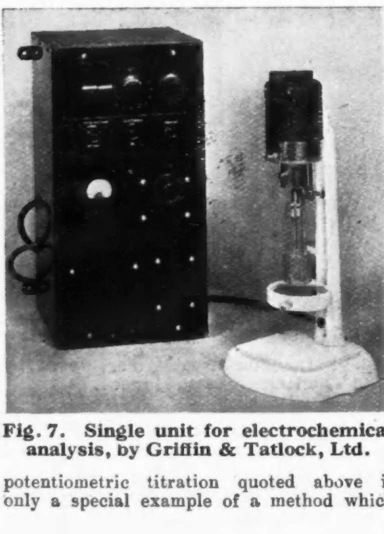


Fig. 7. Single unit for electrochemical analysis, by Griffin & Tatlock, Ltd.

potentiometric titration quoted above is only a special example of a method which

has very wide application. Electrometric titrations, both potentiometric and conductimetric, have many possibilities. In the same category one must consider that young but very flourishing development, the use of the polarograph, which has already a most extensive literature pertaining to it. Allied closely to this is the cognate amperometric titration, as yet in its infancy. All of these methods should be available to the analyst, but the nature of the instruments will vary widely. Where certain special problems only are to be tackled, then permanent set-ups (as in the apparatus already quoted) will be used; but for greater flexibility many analysts will find that a wide range of "bits and pieces," which can be applied variously to the job in hand, will prove very effective. While major developments have been in the inorganic field, it is clear that organic analysis may also utilise electrical methods with increasing frequency.

Electrodeposition methods in analysis, another branch dating back many years, have more recently become "streamlined," so that neat and compact apparatus such as that shown in Fig. 7 is available. The purchase of such apparatus will, of course, depend on the likelihood of their frequent use, but the possibility of carrying out such methods in some form or other must be available to practically any general analytical laboratory. In this connection, the related qualitative methods of electrography should be borne in mind.

The final method which it is proposed to mention is one which at first sight does not appear to fall into the instrumental category, until one refers back to the definition of the instrument as something which gives an answer more directly than the methods of classical analysis. This the chromatographic column can certainly be considered to do, and chromatographic methods, which only comparatively recently have been brought to general notice, are an important weapon in the armoury of the modern analyst. Commercial installations for controlled experiments in this branch, such as that depicted in Fig. 8, are available, and once again personal preference and the needs of the particular laboratory will determine whether such a form, or a more flexible home-made form, will be used.

Specialist Instruments

In this account no attempt has been made to touch on several major analytical advances of recent years, primarily because these have, to a great extent, passed to the stage where they are a matter for the specialist laboratory rather than for even the most comprehensive general analytical laboratory, or because they have, from the first, been the prerogative of the specialist, and because of their complexity are likely to remain so. Such powerful aids as X-ray analysis, electron diffraction methods, and the derived use of the electron microscope and of the mass spectrograph, when used for analytical purposes, are regarded as outside the scope of this article.

In conclusion, I am tempted to end, as I began, on an historical note. Looking back over 60 years is instructive, indicating as it does the advances, both through improving old methods and through devising new ones, which have arisen from the application of the instrument to analytical purposes. One is therefore tempted to look forward yet another 60 years, and to speculate in what way, and to what extent, the instrument will continue its influence. Is it, perhaps, too rash to forecast that by then the combined ingenuity of chemist, physicist, and engineer will have produced a single instrument which will comprehend all analysis, and that the analytical laboratory will be "bounded in a nutshell"?

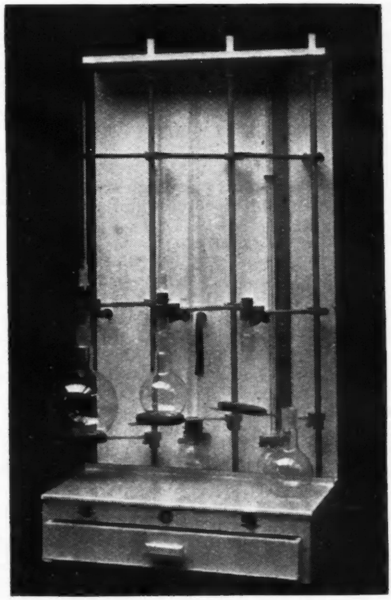


Fig. 8. Stand for chromatography, by Townson & Mercer, Ltd.

The Commonwealth Government of Australia has abandoned the search for oil at the Lakes Entrance field after an expenditure of some £150,000.

Chaos ?

The Fight to Preserve a Vital Industry

by NORMAN SHELDON, A.R.C.S., F.R.I.C.

FOR some years I have been writing to THE CHEMICAL AGE and other technical or daily papers in the hope that I might provoke other chemists to take some interest in the fate of the various industries that make the tools with which they work. When I was invited to write an article giving an up-to-date description of the scientific glassware and laboratory porcelain industry for this special number I felt that I could only reply by sending, in large type, the one word CHAOS.

That, readers may say, is no advertisement for an industry that has fought against tremendous odds in the form of foreign competition and later of official obstruction and has done and is still doing very fine work. When I use the word "chaos" I am describing the situation which is being forced upon the industry by outside circumstances and which the Government of this country insists on aggravating. I say also that it is the fault of the chemists and other scientists in this country who, even when they are told the facts, will do nothing to assist the manufacturers. Eminent scientists urge the manufacturers to press the Government for assistance, but when I point out that unless those who use scientific equipment will make vigorous protests in the right quarters when they have to wait six months or a year for some apparatus, they subside into their usual state of coma at which Professor Laski is so pleased to poke fun.

The Official Attitude

Mr. Herbert Morrison, Lord President of the Council, is responsible for the Department of Scientific and Industrial Research. If you write to him on a matter of utmost concern to Scientific and Industrial Research you will get no answer. Sir Stafford Cripps and Mr. Attlee are in turn responsible for our exports and our security and future as a first-class power. These gentlemen are also quite unresponsive when they are urged to assist industries on which the very life-blood of the nation depends. Not only are the scientific glass and porcelain industries struggling against indifference in the highest places, but almost every other section of the scientific equipment industries is in the same boat.

To understand the position it is necessary to know something of the past; and particularly of the official attitude during the war. This is most revealing and makes it clear that there must be some change in the education of our Civil Servants if we are to build up the highly scientific industrial organisation which alone can save us from poverty or destruction. My own experiences can be taken as an indication of the difficulties experienced by these "Master Key" industries, formerly protected by a special Act of Parliament and declared by the Board of Trade to be "essential for the safety of the Empire" and to be preserved in this country "at all hazards and at any expense."

Between the Wars

From 1875 to 1914 Germany supplied us with most of our scientific instruments. Those who know anything about these matters know that this monopoly was developed as part of their plan for the conquest of Europe. They knew that superiority in scientific equipment meant victory in war—we know it now. In the war of 1914-18 we were forced to sacrifice many lives to hold the enemy while we built up these industries, for superiority in scientific research and in technical equipment is essential and must precede or accompany the piling up of munitions. We won the war and we were told that it had been a chemist's war. I hardly need to repeat our experiences between 1919 and 1939 except to say that we were allowed enough protection to keep some of our factories from complete extinction and to enable a few to develop a reasonable home market. At no time did we get the encouragement that was necessary if we were to take that place in the world markets which was our right. We had little money to spend on research, for the Hun was able to make sure of that. We did hope, however, that if another war came we should be given an opportunity of playing our part to the limits of our energy and ingenuity. How terribly some of us were disillusioned!

Skilled Men Taken

In September, 1939, many of our most skilled men were taken into the armed forces—men who had, in some instances, been trained to do special work at the request of Government departments. One factory making laboratory porcelain was rendered impotent for more than three months although they had installed the most modern plant and, in co-operation with the Chemical Department of Woolwich Arsenal and other important munitions laboratories, had made plans to produce laboratory equipment of the highest quality to replace the German product; men trained to fire

the new furnaces were taken. No one in the factory could control these furnaces sufficiently well to make porcelain, and Government departments and the War Office were quite unmoved when we asked for the men to be returned. The Chief of the Chemical Department at Woolwich Arsenal did his utmost to knock sense into the War Office but, as I was told by a Government official, his appeal was ignored because he was considered to be an interested party. In other words, he was a scientist who needed apparatus for testing explosives and devising new ones. At that time no technical man was treated with respect by the Pooh-Bahs of Whitehall. Finally, he threw in his hand and said that we must fight our own battles.

The Campaign Begins

A letter in *The Times* was suggested as a suitable means of inducing higher officials and members of the Government to take action. There was a risk in this because it would tell the enemy of the folly of our rulers, but something had to be done, and early in November, 1939, *The Times* published a letter in which I exposed the stupidity of the Government. I spent the same morning sending telegrams to Cabinet Ministers, well-known scientists, scientific societies, and anyone whom I thought would help. It created all the interest I hoped for and in one way or another we made the lives of certain people so unbearable that at last they gave in and we were able to get the men back to the porcelain factory and start work again—but not until January, 1940. Governments do not hurry, even in war time. They had to play the game according to the rules of patience.

Meanwhile, there were other factories in trouble which was almost as serious. Some of the most highly skilled glass tube drawers were by this time driving lorries in France. To get them back was impossible—so I was told. To tell the full story of the recovery of those men would take too much space. The work involved included the preparation of a case which was supported by the presidents of three scientific societies and four trade associations. The document was illustrated with a photograph of the men at work, and, with copies of the letters from Government departments, was handed in at 10 Downing Street. It included an appeal to the Parliamentary and Scientific Committee with subsequent questions in the House of Commons. It included a memorable interview with an official of the Ministry of Supply deputed to ask me to cease my agitation because they had no intention of letting us have the men and that they could not answer the last question in the House until I admitted that I was beaten. The question concerned a letter from the Ministry of Supply asking the firm why they had not delivered an urgent order for glass tubing needed for a War Office contract. The reason should have been obvious to them. The real trouble was that the Ministry of Supply had made a bargain with the War Office that they would be content with a certain quota of men back from the Army for urgent work. This quota had been exhausted and they could not ask for more. I indicated very plainly that I was not interested in their bad bargains and said they must go to the War Office, admit their error and ask for our men. I was given a blunt refusal after two hours of bitter argument. I left the room saying that whatever they said I was having those men back. How, I did not know—but in four days I had them beaten—but that is another story. I did it by scaring them.

And so the fight went on all through 1940 and 1941, men being called up—fights with Ministries—calling-up papers cancelled—called up again and so on. On one occasion a calling-up notice was cancelled by the Ministry of Labour and the need for it was denied by the Ministry of Supply. The reason given was that they had 13 other suppliers and yet, in fact, this particular man was the only man in Great Britain doing a particular job and trained to do so at the request of Woolwich Arsenal. The 13 other suppliers all bought the product handled by this man, but of course no Government department could know that each laboratory furnisher did not keep his own porcelain factory in his back yard. The manufacturers were forced to attempt to train no less than 20 people to do this man's work in order that he might go. Not one of the 20 ever acquired enough skill to take his place. All this because officialdom will never believe you are not a liar when you say a man has special skill.

A Flood of Orders

In 1941 we expected to be scheduled under the Essential Work Order but, although the firms who distributed our goods to laboratories were scheduled, we who made it were not. At the same time we were threatened with the loss of our young workers, and we were flooded with orders all of the greatest urgency. The heavy chemical glassware manufacturers were suddenly given huge orders for re-equipment needed for the production of lead azide. I was told that £60,000,000 worth of ammunition had no detonators because this plant was not in action. I was told that aeroplanes could not fly because certain small pieces of laboratory apparatus were not available for the firm who made the equipment for charging the batteries. And yet we were not essential. Before we could be scheduled and before we could get our younger men protected we actually had to force the

matter up to War Cabinet level. We attended meetings and won our point, but the time we lost was heart-breaking.

Crass Ignorance

On one occasion I gained a real insight into the root of all our trouble. A recommendation of the Committee appointed by the War Cabinet to investigate our complaints was not carried out and I insisted on an explanation. Eventually I secured an interview with a member of the Government who had been chairman of a higher body which had turned down the particular recommendation. It concerned scientific glassware. After I had explained the need for the assistance I asked for and discussed it for about ten minutes, this eminent gentleman suddenly said "What is Scientific Glassware?" He had not taken the trouble to find out what he was talking about. Those simple words made it clear that we were up against colossal ignorance. And so it went on and on. Waste of time, waste of labour, waste of effort in every direction. The whole thing was bearable only if one treated it as a comic opera, but on at least two occasions I went to Whitehall offices determined to get what I wanted or appear in the police court the next morning and expose the position before a magistrate.

Now the war is supposed to be over. We are told of the vast sums which are to be spent on research. We are told of the vast quantities of scientific equipment needed for the rehabilitation of the educational and research laboratories in countries occupied by Germany. We have an enormous demand from scientists all over the world for laboratory apparatus which has been denied to them during the war. Every factory has orders on its books which will keep it occupied for two or even three years on many items. Almost every factory could export 80 per cent. or even 100 per cent. of its present output. We could build up the most efficient and extensive scientific instrument industry in the world if we were allowed to do so. We thought we should be allowed to do so.

Havoc !

Again we were wrong. We forgot we had a Government of men who know little of science and who care less. Those who did know something many years ago hold their heads high and refuse to hear our plaintive cry. They make Cabinet rulings which bind the most intelligent Civil Servants and compel them to take our men away. They make it easy for the less intelligent to play havoc with our plans. It has been shown that about 75 per cent. of our workers were young people between the ages of, say, 18 and 35. This must be so, for we are a young industry. We are exceptional. We need a labour force double our present size—some estimate that it should be five times greater —yet we still lose our young men to the forces and cannot recover those who went during the war, but who should return under the arrangements for Class B releases. We are losing an opportunity to gain world supremacy in the production of "Master Key" material. It is more important than any domestic problem and by assisting us no domestic production could be hindered. What is the good of a housing scheme if it is to be blasted to hell because we get behind in scientific research—and that, readers, is the danger.

I have a letter before me now from a manufacturer of glass tubing for thermometers and for every other scientific purpose. He states that his customers ask him to double his output, and his reply is that he must reduce it, for five of his skilled workers are to go soon, and he can recover none of his Class B men. Soon we shall not be allowed bricks to extend our factories. Soon we shall be told that our customers can buy their equipment in Berlin or Tokyo once again.

This article is a call to your readers to rouse themselves and force the Prime Minister, who is primarily responsible for the security and prosperity of this country, to do something for the industries without which all his talk of encouraging research is just so much wasted breath. These are the "Master Key" industries and it is time he recognised the fact. They must be allowed to retain all their present workers and must be given all the assistance they ask for in recruiting new workers or in extending their buildings and equipment

FRENCH CHEMICAL FIGURES

Preliminary estimates show that the production of chemicals in France last February increased in certain sectors, including sulphuric acid (55,000 tons against 54,900), soda-lime (5800 tons against 4218), sodium carbonate (26,000 tons against 19,458), tar distilled (25,000 tons against 24,080), paints and varnishes (11,2000 tons against 9950), and tanning extracts (1245 tons against 1130). On the other hand, decreases in output were noted in calcium carbide (5000 tons against 5627), chlorine (2900 tons against 3171), carbon disulphide (769 tons against 1088), and superphosphates (60,000 tons against 65,000). Production of potash in Alsace was 43,558 tons, against 42,028.

The total quota of coal allotted to the chemical industries has been increased from 156,500 tons in February to 199,000 tons in April, so that new progress should shortly be registered.

On Timing Devices

The Merits and Limitations of Three Types

by L. A. STEINER

THE measurement of time intervals in many physical and physico-chemical determinations and several types of timing devices are in general use both for laboratory testing and for process control. The choice of a suitable timing device is influenced by considerations of accuracy, uniformity, reliability, cost of maintenance, and price. Broadly speaking, the timing devices most commonly used fall into three groups: stop-watches, electric stop-clocks, and precision time interval meters. Each of these groups has its merits and limitations and shall be discussed in turn.

I. STOP-WATCHES

The general design and application of a stop-watch is so well known that no discussion of its mechanism is necessary here. The readings of a stop-watch are, however, too often taken at their face value and it appears useful to discuss their real accuracy.

Stop-watches rely for their driving power on a spring and tend to run slower as the length of measured time period increases. Several specifications on testing procedure prescribe that the stop-watch should be fully wound before the measurement begins.[1] That makes a repetition of the measurement more consistent, but does not improve on the accuracy.

The gradual change in the speed of the indicating hands causes an error in the average speed (*i.e.*, in the indicated time interval), the magnitude of which is not necessarily constant. The error curve of a stop-watch is—as a rule—a complex function of the measured time interval and can be determined by experiment only. Every stop-watch has an individual curve of its own which should be known if the readings are to be regarded as accurate.

Variations in the rate of stop-watches may be demonstrated by using a number of stop-watches and comparing them against each other. This experiment will, of course, not work if any two of the stop-watches happen to have exactly the same error curve, but will give very demonstrative figures if the errors are of opposite direction. The test is indicative of the relative error of one stop-watch against another; a determination of the true error is only possible by comparison against a constant time base, such as is given by a suitable quartz crystal clock or by a device to be described under the heading "constant frequency time interval meter."

If t is the correct time and t_s is the time indicated by the stop-watch, then the error E of the stop-watch (in per cent.) is

$$E = 100\ (t_s - t)/t \quad \ldots\ldots\ldots\ldots\ (1)$$

and the correct time $t = t_s - E.t_s/100$ ... (2)

In order to indicate the general trend of errors four representative curves were plotted in Fig. 1. Curve A is the percentage error of one stop-watch against another, plotted for time intervals up to 400 seconds. Both stop-watches were of good-quality Swiss manufacture, with dials divided in 1/5 sec., and were tested immediately after receipt. It will be seen that the maximum relative error is at about 25 sec. and amounts to 1.25 per cent. At 100 sec. the difference is about 0.4 per cent., and it decreases steadily to somewhat below 0.1 per cent. at 400 seconds.

Curve B is the true error curve of one of the stop-watches measured by comparison with the indication of a timing device with constant time base.

Curve C is the correction curve to be applied to the readings of a selected stop-watch, remarkable for its flat error curve.

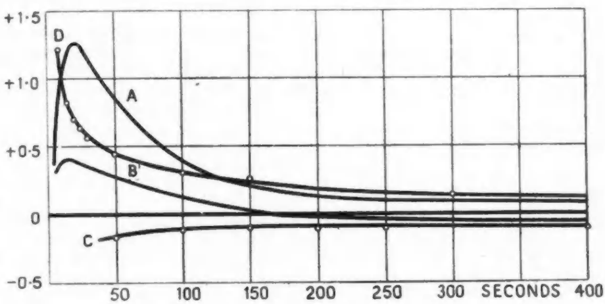


Fig. 1. Error curves of stop-watches: (A) relative error curve of two stop-watches; (B) absolute error curve of one of the stop-watches in (A); (C) correction curve of a selected stop-watch; (D) error curve of two other stop-watches.

Curve D is included in the diagram to show the fallacy of a commonly believed statement. It is generally assumed that stop-watches with finely graduated dials are more accurate, and this curve shows the relative error of two stop-watches graduated in 1/20 sec., with divisions large enough to estimate 1/100 second. In order to be sure of precision, every point was repeated 10 times and the average taken; to avoid personal errors the crowns of the stop-watches were pressed simultaneously by an electro-magnetic device. It can be seen that the errors are of the same order as those of the pair represented by curve A, although the stop-watches which gave curve A could be read to 1/5 sec. only. The conclusion is justified that the real accuracy of stop-watches does not always correspond to the graduations of the dial, however, open these may be.

Unpredictable Errors

While the curves in Fig. 1 represent the general trend of errors, exceptions are not unknown. For instance, the following results were obtained for a stop-watch of commercial quality:

Interval time, secs.	Corrections to be applied, %
50	+0.02
100	+0.00
200	+0.07
400	+0.04
800	+0.06

The corrections determined by proper calibration are valid for a limited period only and it is impossible to predict the period of validity. Frequent re-determination is necessary whenever a consistent accuracy is required. Design, mechanical conditions, regulation, and care in handling are the factors influencing the error curve of a stop-watch when new. There are also other sources of trouble which cannot be so easily taken into account in actual use, such as the effect of temperature, position, mechanical damage, etc.

The balance wheel of a stop-watch should be temperature-compensated, but compensation is seldom perfect. For balance wheels which are not compensated a temperature difference of 10°C. causes an error of about 0.12 per cent. Temperature variations influence, however, not only the balance wheel but also other parts, in particular the power of the mainspring and the efficiency of lubrication. Consequently, temperature effects are not necessarily negligible.

As a rule the stop-watch is used in a position different from that in which it was regulated or calibrated and there is a change in friction of the bearings and of the gear train. Friction is the only resistance which has to be overcome by the driving power of the mainspring and changes in frictional resistance have a marked influence on the rate of a stop-watch.

Shock has an adverse influence both on the accuracy and lifetime of any stop-watch, and rough handling (which includes jerkiness) should be discouraged both during and prior to actual use. It is advisable to use suitable holders or frames in which the watch can be permanently fixed.

Stop-watches are not, as a rule, suitable for continuous use, and wear out quickly when used all day and six days a week. One point to consider is that juniors will investigate the works, trying to do repairs or in search of knowledge; another is the easiness with which stop-watches can be borrowed. The loss of a stop-watch may be due to a sporting event during the week-end from which it sometimes does not return. However, stop-watches are not without merits. Their chief advantage is portability, they take up little space, and their price is comparatively low. For occasional use, and for applications where an accuracy of ±1 per cent. is satisfactory, a stop-watch is economical and convenient, but for continuous use, or where a number of timers must run synchronously, or where better accuracy is required, other means of measurement should be considered.

II. ELECTRIC STOP-CLOCKS

What is usually called an electric stop-clock is a mains-driven timer, consisting of a synchronous motor and associated gear. Compared with mechanically driven stop-watches, they have definite advantages, in so far as they are independent of temperature, independent of position and shock, are more robust, and cannot be easily mislaid; and, if more than one electric stop-clock is being used, all would run exactly at the same rate, *i.e.*, in perfect synchronism, assuming, of course, that the motor is not overloaded.

Unfortunately, the speed of such a device is dependent on the frequency of the mains, and the frequency of public mains is seldom sufficiently constant to ensure a better accuracy than that of a normal stop-watch. In this country and in most other countries the frequency of the public mains is sufficiently controlled to ensure that all synchronous clocks will indicate the time accurately enough for domestic and public use, but, as a rule, not accurately enough for laboratory use.

Assuming that the mains-driven clock at the control point of a power station is running too slow for a long period, the supervising personnel takes steps to accelerate the generators for a sufficient duration, so that (observed over very long periods) the synchronous clocks are never too far out of the correct time. During the periods of

adjustment, however, the frequency may vary considerably and this is the reason for the poor accuracy of all time-interval meters which rely on the frequency of public mains.

Morrel and Oman[2] recorded frequency errors of the mains in London in 1938 by an ingenious device specially constructed for the purpose. They found that variations seldom exceeded 0.5 per cent. for a well-controlled grid system. In many factory supply systems there is no control of frequency at all, and it is to be understood that even the public mains may deviate in frequency considerably if the demand on the supply system suddenly increases. Under present conditions deviations of ± 1 per cent. from the nominal frequency are nothing out of the common. After all, the main purpose of electricity supply systems is the distribution of power and not the regulation of time signals.

III. CONSTANT FREQUENCY METERS

Mains-driven timers have practically no disadvantage other than the uncertainty of the driving frequency, and it is here that use can be made of methods applied in radio technique. It is generally known that broadcasting, telecommunication, and television relay on constant generators for performance, and several types of gear are known and fully developed.

Modern electronics supplies convenient means for amplifying very feeble signals. The technique of gaining an output sufficient for timing purposes is well understood, and electronic devices are, in general, less liable to wear out than mechanical ones. It is one of the most valued advantages of electronic amplification that it requires no moving mechanical parts and that it acts quicker than any mechanism. The frequencies supplied by electronic devices are

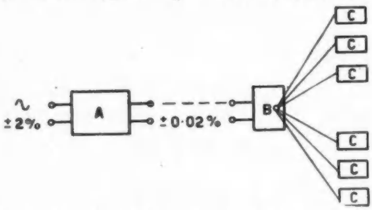


Fig. 2. Diagram of timing device of constant time base (A. Oscillator. B. Amplifier. C. Time-interval meters).

far too high to be applied directly, and the original frequency is usually subdivided in order to arrive at a sufficiently low speed which may be handled by mechanical devices, the latter being necessary to indicate visually elapsed time intervals of longer duration.

In the quartz crystal clock, for instance, the original frequency at which a thin cutting of quartz crystal oscillates may be 1 megacycle (1,000,000 cycles/sec.). This is then subdivided by several stages to a

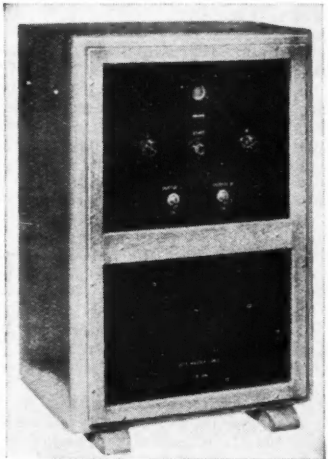


Fig. 3. Steiner Master Timer, with accuracy of output frequency ± 0.02 per cent. or better, and capable of driving ten time-interval meters.

more convenient frequency and used to control the speed of a clock or other apparatus. A tuning fork may also be used in the same manner and the literature dealing with the application of oscillators is very voluminous. The first account of a timing device for routine laboratory measurement based on the above principles was given by Frey and Baldeschwieler[3] who arrived at an output of 8 watts at a frequency of 60 cycles/sec. Further reduction of frequency and simultaneous increase in possible output enabled them to drive several dozen time recorders. Penther and Pompeo[4] reported on a similar device and reached by the aid of electronic tubes an output of 120 watts, and their arrangement ultimately worked 48 time recorders.

The author's timing device was conceived with the idea of furnishing equipment of good accuracy, using so far as possible standard parts which may be easily serviced when necessary. The general scheme is represented in Fig. 2 in which three groups of components are denoted by A, B, and C respectively. A is the oscillator unit, mains-operated, and receiving 200 to 250 volts a.c. at a nominal frequency of 50 cycles/sec. which may vary ± 2 per cent. without noticeably impairing accuracy. The output of the oscillator is stable within

±0.02 per cent. and is then amplified by amplifier B which, in a standard unit, is capable of driving 10 time-interval meters, marked C. In the latest design (Fig. 3) the oscillator and amplifier are housed in a common cabinet, called the Master Timer and the timing units may comprise 1, 3, or 6 meters (Fig. 4).

The time-interval meters are impulse counters and represent elapsed time intervals in 1/5 sec., and a total of 10,000 beats (=2000 seconds) can be recorded. When the figure 10,000 is reached the recorders run further without stopping and without damage to the unit. It will be noted that numbering does away with conversion of minutes into seconds, and requires less mental work in computations. Errors in working out results are thus to some extent avoided.

The operation starts by pressing a button below one of the meters and ends with pressing the same button. Two or more meters may be started simultaneously and stopped singly at any time, just when an intermediate event finishes. There is no difficulty in subdividing a complete operation into six individual intervals by using a timing unit with six meters (Fig. 4, top). That arrangement is especially valuable for the study of complicated phenomena or

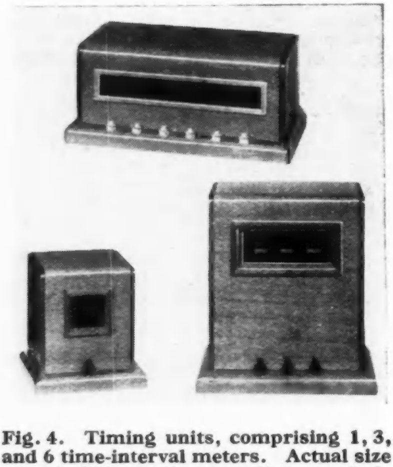


Fig. 4. Timing units, comprising 1, 3, and 6 time-interval meters. Actual size of each digit on the recording panels is 5/32" by 3/32", permitting good visibility at a reasonable distance.

where a number of measurements might run concurrently.

Some of the observations recorded in 1942 on one of the first models have been tabulated in a previous paper[5] and show that on nine days out of ten the accuracy was better than 0.02 per cent. Since then a large number of observations have been made on the constancy of the frequency of the oscillator of every master timer produced. These observations are made once a day over four intervals of about 600 sec. each against the readings of another timing device which is known to be accurate within 1 : 100,000. Fig. 5 is a typical example of an observation over a period of 60 days, taken during October-December, 1944, in London at the time of the rocket attacks. At that time the variation of voltage and

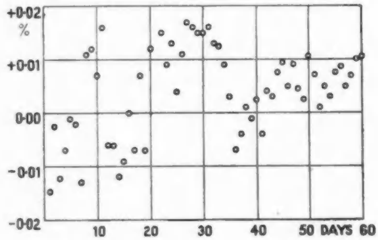


Fig. 5. Errors of master-timer observed over 60 days (Oct.-Dec., 1944).

frequency were particularly heavy and irregular. It can be seen that oscillator frequency was well within ±0.02 per cent., the errors being a sum of influences due to variations in voltage, frequency, temperature, and other causes.

Although there are no technical difficulties in constructing a master timer and the associated gear to an accuracy of ±0.002 per cent. or better, an accuracy of ±0.02 per cent will be found perfectly satisfactory for the majority of precision measurements in industrial and research laboratories and is, naturally, more economical.

By virtue of the fact that the time-interval meters are only electrically connected to the master timer, a further application is opened up in a plant where a number of buildings might require facilities for accurate timing. Fig. 6 shows the lay-out of an installation in which several buildings are served by the same master timer. The wiring is the same as for normal telephone lines, and distances of up to 0.7 miles are permissible for standard timing units. In the particular installation represented in the figure, a number of relay points were interposed between master timer and timing units, chiefly for the reason of security, *i.e.*, in order to prevent an accident in one of the buildings from causing a nuisance to the timing system in the other buildings. At the same time the relays enable an increase of the number of meters to 10 per relay in any part of the plant.

One would expect equipment of the type described in the last paragraphs to be

fragile and costly to maintain. That may be so if untried components are used, or parts good in themselves, but not suitable for the purpose in question. Although the laboratory collapsed on a master timer without putting it out of order. It had been working for two years before the accident and is still in working order now. After

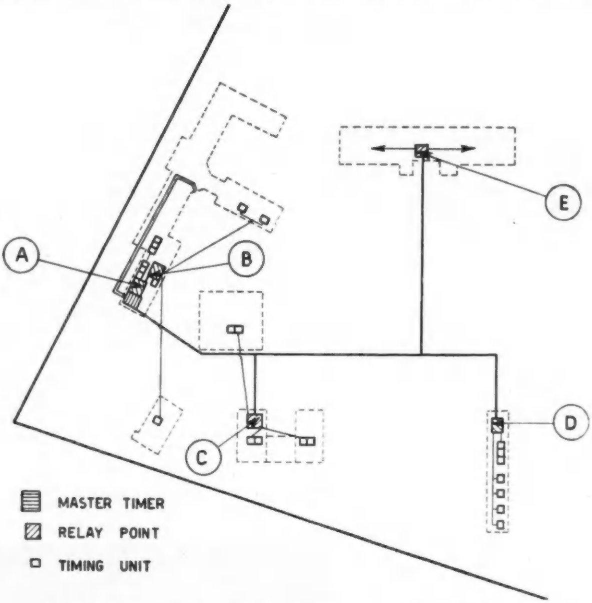


Fig. 6. Lay-out of master timer and timing units for use in six different buildings.

principles of operation may be the same, a component which has rendered good service in, say, a radio receiver, is not necessarily satisfactory in a timing device. For one thing, a radio receiver works interruptedly, while a master timer has to work for at least 8 hours per day. A further point is that the atmosphere in a chemical laboratory is corrosive and causes the quick deterioration of ordinary components.

If, however, the actual requirements are properly taken into consideration, a master timer will outlast less accurate devices. As an example of the robustness of a master timer it may be quoted that during the rocket attacks on London the roof of a a total of more than three years' continuous operation (24 hours a day, seven days a week) there is no sign of an approaching breakdown in sight.

The installation of a master timer can, of course, be recommended only where its superior performance can be utilised, *i.e.*, where either accuracy is an overriding consideration or where the existence of a number of time-interval meters is of advantage.

REFERENCES.

[1] *e.g.* B.S.I. Specification 188/1937.
[2] MORREL and OMAN, *J. Inst. Elec. Eng.* 1942, *87*, 507.
[3] FREY and BALDESCHWIELER, *Ind. Eng. Chem. Anal. Ed.*, 1940, *12*, 472.
[4] PENTHER and POMPEO, *Electronics*, 1941, *14*, 20.
[5] *Petroleum*, 1943, *6*, 72.

As the result of a systematic survey of the antibiotic-producing capacities of penicillia contained in the National Collection of Type Cultures, which has been carried out at the Indian Institute of Science, Bangalore, twelve strains of penicillia have been selected for further study as potential sources of penicillin.

A pilot plant for the production of titanium dioxide from bauxite sludge has been set up in the laboratories of the Council of Scientific and Industrial Research at Delhi. The plant, which has a production capacity of 20 lb. per day, has provided valuable data on the commercial feasibilities of the process for the production of titanium whites.

British Laboratory and Technical Porcelain

A Warning from History

ALREADY in 1870, at the time of the Franco-Prussian war, Bismarck realised the important part that science would play in those future conflicts which would be necessary if Germany were to attain her aim of world domination. Plans were laid, therefore, for achieving a world monopoly or near-monopoly of certain essential scientific instruments and also of scientific porcelain and glassware on which so much research ultimately depends.

As far as laboratory porcelain was concerned these plans met with particular success. Up to 1914 almost all the laboratory porcelain used in Great Britain and the United States was imported from Germany—the highest grade coming from the State Porcelain Works, Berlin. No English potteries had even attempted to produce this ware and the abnormal demand from scientists and technicians in the early months of the 1914-18 war soon depleted the available stocks of German porcelain. A critical situation arose which threatened to impede scientific research.

The story of how this crisis was overcome has been told before. Within a period of a few months, as a result of intensive research, two famous British potteries managed to produce a range of laboratory porcelain equipment which compared remarkably well with the German products, themselves the result of 150 years' manufacturing experience. In resistance to acids and alkalis there was little to choose between the new British porcelain and the German, but in resistance to high temperatures and thermal shock the British ware was below the German standard. Between 1915 and 1918, however, steady improvement was made in this respect and since that time, despite the relatively insignificant sales of laboratory porcelain compared with say, decorated china and earthenware, and despite the fact that between 1918 and 1939 German ware was again imported by many laboratory suppliers, British makers continued their researches with the result that the quality of their wares was consistently and continuously improved, and on the renewal of

Fig. 1 (below). Laboratory porcelain in use.

Fig. 2 (above). Casting laboratory porcelain crucibles.

war in 1939 they were able to supply the demands of scientists not only in this country but in Canada, Australia, South Africa, India, and many other parts of the world. In 1939 the total exports of porcelain for laboratory and industrial purposes only amounted to £3442. By 1942 the total value had risen to £15,107.

British china and earthenware have, since the second half of the 18th century, achieved a perfection of material, glaze, and design unequalled by the products of any other country. It may be wondered, therefore, why no attempt had been made until 1914 to compete with Germany in the sphere of laboratory porcelain. Among other reasons for this two are outstanding. One a matter of history and the other of economics.

In the first place, except for a short period at Plymouth, none of the British potteries had made any sustained attempt to use *hard porcelain* for decorative wares. English china is composed of china clay, Cornish stone, and bone ash—whereas in continental china the usual ingredients are china clay, felspar, and quartz. These are also the principal ingredients used in making laboratory ware. The perfection of bone china by Josiah Spode, towards the end of the 18th century, led to Germany's losing a large share of the world market for the higher-priced table and decorative wares, for which the translucency and delicate glaze and colour effects of bone china were recognised as superior to anything that could be achieved in hard porcelain. Germany, however, continued to concentrate on this material, which is cheaper to produce than bone china and, as the demand for laboratory porcelain was so slight a percentage of the total for pottery in general, it came about quite naturally that this was left in German hands, although small quantities of a less technically efficient ware were produced in France.

An Expensive Business

The second reason was that without some official encouragement, and even financial aid, no British manufacturer had, before 1914, any inducement to embark on the costly research work involved, which even now is out of all proportion to the return compared with other pottery products. The many different types of apparatus needed call for the preparation of special models and moulds, always an expensive matter, and the high chemical, physical and thermal requirements necessitate constant control of raw materials and special manufacturing plant and kilns.

It was unfortunate that after the 1914-18 war, as soon as German ware again became available, many users went back to it, especially when, with the aid of subsidies, the German makers were able to sell their products at lower prices than the British. It is for this reason that we have devoted so much space in this article to historical explanations, in the hope that history will not repeat itself. It must be stressed, however, that there were those—both laboratory suppliers and users of laboratory porcelain—who took the longer viewpoint, and it is in no small measure due to their encouragement, advice, and friendly criticism that the progress made in British laboratory porcelain within such a short period has made it possible to meet the most exacting demands of scientists and research workers during the past six years. British makers have installed new plant and special kilns and greatly increased their personnel in the laboratory porcelain section, and there is not the slightest question that with the great traditions of British pottery-making behind them, given continued support, they can produce a ware that will not merely be as good as the pre-war German hard porcelain, but even superior to it. Up to now the British laboratory porcelain industry has been treated as a kind of Cinderella of the pottery industry, elevated to a place of honour in 1914 and 1939 and then relegated to an inferior position immediately the urgent need was over. Whatever the official Government attitude may be towards the revival of the German porcelain industry, it is to be hoped that laboratory suppliers and users of laboratory porcelain will give this small but important section of the British pottery industry the encouragement it both needs and deserves.

Fig. 3. Porcelain apparatus for micro-analysis.

Special War Material

During the war years, apart from ordinary laboratory equipment, mention must be made of certain specialised technical plant supplied for use in the electrical industries and in the manufacture of parachutes, webbing equipment, medical sutures, synthetic threads for motor tyres, and other materials of great importance in war time. There was also a considerable demand for porcelain glove-formers for shaping the

rubber gloves used by surgeons and nurses as well as for industrial purposes, especially in connection with electricity. Many intricate porcelain parts have also been supplied for use in the textile and rayon industries. Porous ceramic filters were extensively used during the war in the metal-plating industry, the improvement effected by the filtration of the plating solutions being very pronounced in the finished articles. In connection with chromium plating, an important development was the device known as the "Dechromator." This was utilised to increase the length of service of chromium plating bath solutions in view of the serious shortage of chromic acid. Electrolytic processes have been adopted in many other spheres, and British potteries have met requirements for porous cells with a low degree of resistance to current. Special porous parts were also supplied for use in mines and anti-submarine devices.

There has been a great extension in recent years in the use of porous ceramic filters made of porcelain and other materials for the filtration of liquids and gases and for the diffusion of gases or liquids in liquids; also for the separation of colloidal matter from liquids. Several standard porosities are available and these filters are used in the chemical, pharmaceutical, food, cosmetic, and other industries. Because of their excellent resistance to corrosion, coupled with good mechanical strength and resistance to thermal shock, ceramic filters have in many cases replaced earlier types of filtration media and there is every indication that their application will extend.

Finally, one special development in laboratory porcelain which is likely to prove of increasing importance is the manufacture of tiny crucibles, dishes, funnels and similar apparatus for use in micro-analysis—a special technique which is being increasingly used both for qualitative and quantitative analysis. A group of porcelain apparatus for micro-analysis is shown in Fig. 3, on the preceding page.

Laboratory Ware

Standard Designs Published

THE Technical Committee of the British Laboratory Ware Association, Ltd., is engaged in revising the designs, and providing detailed drawings for use by its members, of general chemical apparatus in common demand, for which hitherto there has been no accepted standard in this country. In part this work was begun as a wartime "rationalisation" measure limiting the number of different types serving parallel functions. Its success has, however, by general consent, been such that the work is being continued and extended. In preparing these designs, the committee has considered recently published work (*e.g.*, the narrow-jacket West type condenser displaces the wide jacket conventional Liebig condenser) and the use of such standard moulded components as are available

Accordingly, Mr. R. H. Powell, convener of the Technical Committee, has addressed a letter to scientific and technical organisations and associations, suggesting that, in so far as this apparatus is applicable to their methods or specifications, they would take acount of the various types in any new or revised editions of their specifications. If they could be applied to existing specifications the advantages in economic production which would accrue would be not inconsiderable.

An attached list shows the drawing numbers and titles of apparatus which have been covered to date. These include standard blue prints of Condensers (8 types), Drying Tubes (5 types), Potash Bulbs (9 types), Gas Wash Bottles (3 types), and Orsat Gas Analysis Apparatus (4 types).

Exhibition of Instruments

Forthcoming Event in Sweden

LATEST developments in British scientific instruments will be shown at an exhibition which will be held in the Technical Museum, Stockholm, from May 24 to June 4, under the auspices of the Scientific Instrument Manufacturers' Association of Great Britain and of the Royal Institute of Scientific and Engineering Research of Sweden.

Scientific instrument developments have been particularly remarkable during the war years. Instruments once in short supply and seen only in the laboratory are now mass-produced for industrial use without any loss of accuracy or reliability. Many of these instruments will be on show at the exhibition, the whole of which should present a well-balanced picture of the products of British scientific instrument makers, serving to introduce them to a market formerly monopolised by German firms. Forty-one British manufacturers will exhibit examples of their latest apparatus, and in addition to the trade displays, a collection of photographs and of early instruments of historical importance has been organised by the British Council.

Prominent British scientists, including Sir Charles Darwin, director of the National Physical Laboratory, will deliver addresses during the exhibition on various British achievements in the fields of science. Films, illustrated lectures, and demonstrations by the technical experts of some of the exhibiting manufacturers will provide other attractive features.

Continuous Measurement of Specific Gravity

Apparatus for Process Control

by L. B. LAMBERT

MOST processes can be controlled on a straightforward basis of temperature, pressure, flow, or *p*H, but there are some —and they tend to increase in number— where the most convenient method is a measure of the specific gravity of a solution. The majority of these are continuous, so it becomes desirable to have apparatus which will continuously indicate or record the specific gravity to enable the plant to be manually controlled, or modifications of these providing for automatic control.

Early devices employed floats immersed in the solution and linked to some form of weighing mechanism which measured changes in buoyancy. These have the merit of simplicity, but were very limited in application and suffered a high mortality owing to effects of corrosion. The development of suitable differential pressure manometers enabled pneumatic methods to be adopted, and it followed that the instrument portion could be removed from the corrosion area to a safe position while those parts exposed to rapid deterioration could be quickly and, in most cases, cheaply replaced. Our present purpose is to outline three methods of measurement and one of automatic control, all of which assume a point in the process where the solution is at atmospheric pressure, that a supply of compressed air is made available, and that there is no disadvantage in bubbling a small amount of air through the solution.

A Continuous Record

The first scheme gives a continuous indication or record, but necessitates drawing a sample or, preferably, conditions where it can be interposed between two units in the plant. The sample container (*see* Fig. 1) gives a fixed depth of liquid into which a depth tube or standpipe is inserted to a fixed immersion. A baffle plate *E* is used to ensure that the sample passes through the container and not straight across to the outlet. Air under pressure is fed, *via* a shut-off valve, an air flow sight gauge, and a restriction *A*, to the system, whence it escapes at the base of the standpipe. The pressure in the system equals the pressure due to the head of liquid above the lower end of the standpipe, which will vary with the specific gravity and be shown on the instrument. The latter should have two scales, one giving the total head and the other the portion of the scale due to the increase of specific gravity above unity. Thus, if the immersed length of the standpipe is 24 in., the pressure shown with water flowing is also 24 in., but if a solution of 1.5 specific gravity is flowing, the pressure is 24 × 1.5, which equals 36 in. Assuming this to be the maximum to be measured, the first scale *S*1 would cover 0-36 in. and the second scale *S*2 would begin at 24 in. and finish at 36 in., *i.e.*, only two-thirds of the former. This portion of the scale could be

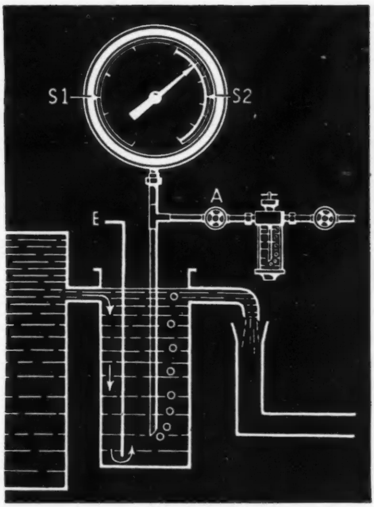


Fig. 1.

graduated in terms of specific gravity, degrees Twaddell, or degrees Baumé. It should be appreciated that this scheme is successful only when the specific gravity to be measured is well above unity, so that the proportion of scale *S*2 to scale *S*1 is sufficient to give reasonably open graduations. It would not, for example, give good indications, where the readings of interest lay between 1.01 and 1.02, as the range covered would only amount to 1/102. The purpose of the total pressure scale is to facilitate checking the accuracy of the instrument on a pressure basis and independently of specific gravity measurement.

The second scheme is a development of the previous one, but is arranged for use in a container in which the level must be

allowed to vary. In this case two standpipes are immersed below the level variation of $L1$ to $L2$ (*see* Fig. 2) and have a different immersion. Air is fed to both *via* restrictions $R1$ and $R2$, so that the pressure transmitted to the instrument is due to the head D. It should be noted that the latter is of the differential type, which, in practice, imposes some limitations additional to those already mentioned, as this instrument cannot be made with sufficient sensitivity to detect the very small changes in pressure involved and, at the same time, withstand the static pressures inseparable from the pneumatic method. The maximum length between $L1$ and $L2$ is in the vicinity of 3 ft. The actual figure varies with the specific gravity variation, and the greater the latter

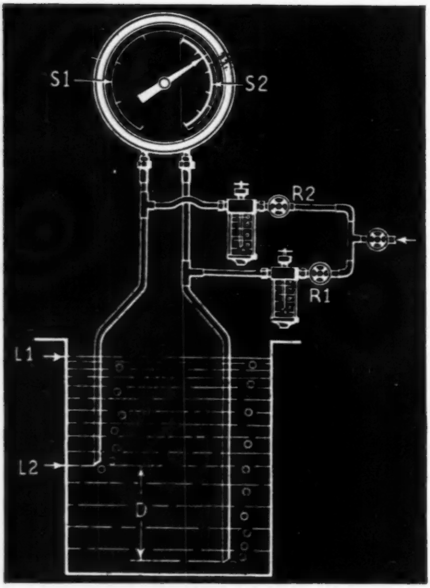


Fig. 2.

the more the length can be allowed to vary, with the maximum at about 3 ft. 6 in.

Under some conditions the standpipes can be carried on a float and connected to the rest of the system by means of flexible tubing. This enables it to be used for greater changes in level, which can be taken as those determined by the convenience with which the connections can be made.

Where the solution is of a corrosive nature the restriction valves should be kept well removed from the container, and in these circumstances an extra air flow sight gauge should be used, so that there is one in each line, as shown in the diagram. A main valve is also desirable so that the outfit can be shut down without interfering with the setting of the restriction.

It will be apparent that better results can be obtained from the pneumatic method if the portion of the head pressure due to water is cancelled out, and that due to gravity left to operate the instrument. This can be done by adding water column A, as shown in Fig. 3, to the short standpipe. The device can be constructed from standard pipe fittings. It requires a water inlet B, an overflow C to set the level, a drain D, an air inlet to the small standpipe in the water column unit, and an air outlet to the main standpipe immersed in the liquid the specific gravity of which is to be measured. The rest of the arrangement is as before. The air is passed through a restriction $R1$, down the small standpipe, and thence through the main standpipe, so that the pressure required to force it through both these is equal to the sum of the two liquid heads. The third and longest standpipe is connected in the usual way, and the pressure in it is that of the liquid head above its base. It is essential that the height of the water column A equals the difference in length of the two main standpipes. The operation of the device is as follows:

The pressure of the water column A equals the height of the column multiplied by the specific gravity at unity. That due to the operation of both standpipes, corresponding to E, is equal in all respects and cancels out. The pressure F is equal to the head difference between the two main standpipes multiplied by the specific gravity of the solution. Pressure A is differentiated with pressure F so that the pressure transmitted to the instrument is that due to specific gravity above unity. This enables the instrument scale to start at unity and permits ranges such as 1/1.25 sp. gr., thus giving more open graduations over the range of greatest interest.

The fourth scheme, shown in Fig. 4, covers automatic control of specific gravity. This has not yet been used by industry to any great extent but, with more continuous processes employed, an increasing interest in the subject is apparent.

Most installations will involve the control of a valve regulating the flow of a diluent to a solution, with a view to maintaining the resultant mixture at the required specific gravity. It may sometimes be necessary to control a steam valve supplying heat to a solution so as to reduce it to the desired concentration by evaporation. The control lay-out is much the same in each case, except for the medium flowing through the controlled valve.

Air is used at three points, first for the measurement of specific gravity by the differential standpipe method previously discussed, secondly or amplification of the

resulting differential pressure and transmission from this unit to the controller, and thirdly for the operation of the controller and the controlled valve.

The use of an amplifier enables smaller pressures to be measured and thus permits shorter standpipes or, alternatively, the detection of very small changes in specific gravity. The amplifier is a relay device which gives an output pressure varying in relation to the input pressure, but on a higher value level. It should be appreciated that this device also suppresses the unwanted portion of the scale, so that the range can be limited to that of real interest.

Obviously, the diluent must be rapidly mixed with the solution and this necessitates considerable turbulence. The standpipes must be near the point of mixing and, hence, exposed to some risk of error due to this. A stilling box will be sufficient to break down the effect of the turbulence without interfering unduly with the detection of changes in gravity. If an agitator is used, some of the motion imparted to the solution can be employed to cause it to flow into the stilling box.

Referring now to the diagram : air is fed, *via* the usual accessories, to the differential standpipe *A*, which could be dimensioned to give a pressure of 0.2 in. w.g. for the maximum specific gravity to be measured. This pressure difference is applied to the amplifier *B*, which steps it up in the ratio of 690 to 1 and passes this increased pressure on to the controller *C*, which can be of an indicating or recording type. The controller permits more, or less, air to flow to the head of the diaphragm valve and this regulates the amount of the diluent fed to the mixing chamber.

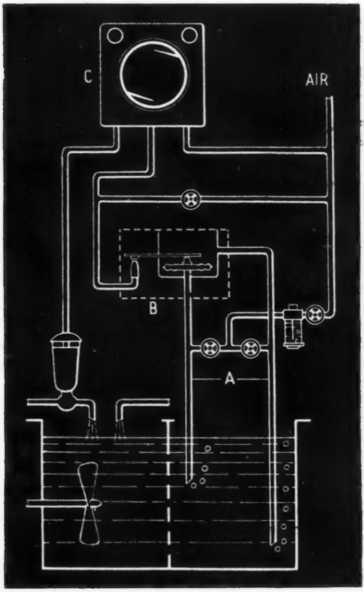


Fig 4.

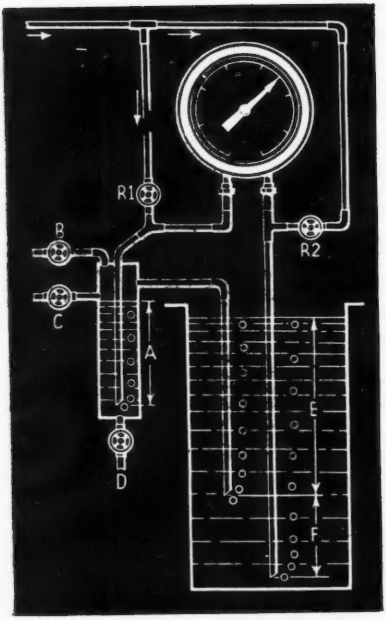


Fig. 3.

In the case of concentration by evaporation, the diaphragm valve regulates a steam supply to the heating coils immersed in the solution, and cuts off the heating medium when the desired specific gravity is attained. The former scheme is, of course, a continuous process and needs a controller of the stabilised type, whereas the latter is a batch process and can be taken care of by a controller of the fixed narrow throttling range type.

When engineering a scheme, first ascertain the essential data applying to the instrument to be used and then work out the standpipe details, selecting material which will not be affected by the solution in which it will be immersed. Choice of the scheme employed is governed by the conditions and requirements. There is much scope for ingenuity in this form of instrumentation, but the results will justify the time and effort involved.

Trade in March

Further Increase in Chemical Exports

A STILL greater increase in the value of the exports of chemicals, drugs, dyes and colours from the U.K., as compared with the previous month is recorded in the Board of Trade accounts for March. The figure given is £5,793,695, which is £510,178 more than the February total and no less than £3,180,313 greater than the figure for March of last year. For the three months ended March 31 last the total is thereby increased to £15,898,287, which is £8,695,426 more than for the like period of last year. British India was again the biggest customer during March, her purchases totalling £578,797; the Union of South Africa was second, with £406,650; and Australia third, with £392,918.

Although recently there has been a downward trend in the value of imports, the March figure of £1,586,187 is an increase of £516,760 over that for February and is £156,591 in excess of the total for March last year. The total of £3,789,254 for the three months ended March 31 last is, however, less by £2,120,042 than the figure for the corresponding period of 1945. The largest supplier during March was the Argentine Republic, with goods valued at £323,107; the U.S.A. was second, with £300,122; and the Union of South Africa third, with £100,159.

Minerals in Nigeria

Big Increase in Output of Tin

THE geology and mineral resources of Nigeria are dealt with comprehensively in an article which Dr. F. Dixey, Director, Geological Survey of Nigeria, contributes to the latest issue of the *Bulletin of the Imperial Institute*—No. 4 in Vol. XLIII.

It is pointed out that tin ore is by far the most important mineral product in Nigeria, output having steadily increased since it was first exported from the Colony in 1905. After the loss of the Malayan tin mines, Nigeria became, in 1942, the leading tin producer in the Empire. Production rose from 13,016 tons in 1913 to 17,258 tons in 1944. The columbite alluvials of the Plateau were of especial value in relation to the war effort. More than 6000 tons of columbite have been produced in the past ten years, and in 1944, out of a total production of 2072 tons, the Associated Tin Mines of Nigeria obtained more than 1000 tons of the mineral by re-treating the alluvial tin-mining dumps. Tantalite exports went up from two tons in 1943 to 13 tons the following year. Salt, galena ("antimony"), clays, limestone, laterite, etc., are worked for local use. Investigation of possible sources of oil will soon be resumed.

Norwegian Chemicals

Export Trade of Norsk Hydro

SPEAKING at a meeting of the Norwegian Export Council, Mr. Bj. Eriksen, managing director of the Norsk Hydro, recently gave some details of the production of his firm. Output of concentrated nitrates in the three plants of Rjukan, Notodden, and Heröya at present amounts to 90,000 tons, which represents about 600,000 tons of commercial products. Production capacity of sodium amounts to 21,000 tons, and that of argon to 4000 cu. m. In addition, the concern is manufacturing rare gases and other products of less importance to the export market.

During the present season (1945-6), estimated production will amount to 88,000 tons of nitrogen, 17,000 tons of cyanamide, and 3800 cu. m. of argon. The production of pure nitrogen is being used, to the proportion of about 3000 tons, for the manufacture of "nitrated technical products," notably nitro-chalk fertilisers. Of the 88,000 tons to be produced this season (against 83,000 tons in 1938-9), 25 per cent. (against 13 per cent.) will be sold on the home market; in 1938-9, exports by the Norsk Hydro of nitrogen reached 72,000 tons, most of which went to Denmark, Sweden, the United States, and Egypt. In 1945, total Norwegian exports of nitrogen amounted to 75 million kr. in value, or 23 per cent. of total exports, while in 1938, exports of the Norwegian Nitrogen Company totalled only 54 million kr., or 7 per cent. of total exports.

For the 1945-6 season, the Combined Food Board at Washington has fixed the total exportable by the company at 65,400 tons, of which 30,000 tons must be sent to Denmark, 15,000 tons to Sweden, and 10,000 tons to France. Exports of argon during this period are estimated at 3500 cu. m., against 1800 in 1938-9, valued at 300,000 kr., against 150,000 kr. The total value of all exports by the concern for the current year should amount to some 80 million kroner.

Aluminium Production

The Minister of Commerce, Mr. Evensen, has stated, in the Storting, that owing to difficulties of export, only two Norwegian aluminium factories are at present operating out of six possible, and that, at this rate, the production of aluminium in 1946 will not exceed 7000-8000 tons, against 36,000 tons before the war. The investments made in the Nordisk Letmetall, the light metals concern formed by the Germans during the occupation, seem to have reached about 1 milliard kr., of which only a very small part can be saved, so that there appears to be much leeway to be made up in this quarter.

New Towers Equipment

Recent Advances

TWO new air-damped balances designed by J. W. Towers & Co., Ltd., Widnes, have recently been announced. Their aim has been to improve upon previous designs, and to produce instruments which will shorten the time taken in weighing, remove the tedium, and avoid risks of error. Weighings may be made in about one-third the time taken with an ordinary analytical balance, and where a large number of routine weighings have to be made daily, balances of this type are invaluable, and are the most economical instruments for the purpose. The

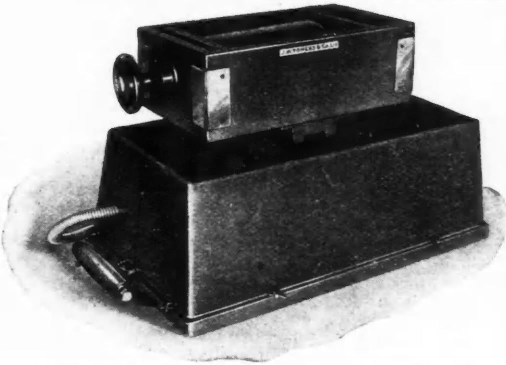


Fig. 2. General-purpose laboratory shaker.

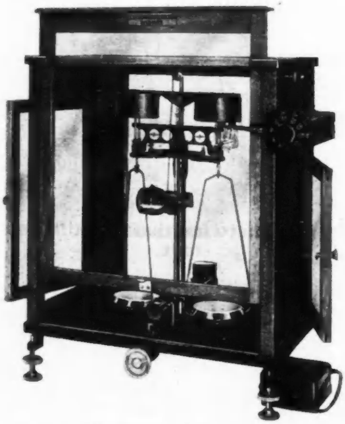


Fig. 1. Towers Model 100 air-damped balance with projected scale and mechanically operated fractional weights.

balances are based on the Towers Model 75 with double arrestment, which has proved itself to be of sound construction. The air-damping cylinders are fitted over the top of the hangers, assuring parallel movement. Placed in this position, the damping system is free from dust and does not obstruct the normal pan space. Ample clearance is provided between the inner and outer pots, eliminating any possibility of contact. A compact optical system is used which does not interfere with free movement inside the case, and the projected scale is at eye-level This scale has a centre zero, and the lines and figures are white against a black background, for easy and comfortable reading.

The Towers Model 95 Air-Damped Balance is fitted with a graticule divided 0-100 mg. in. 1-mg. divisions, whereby 0.01 g. weights are not required. It comes to rest rapidly, and is ideal for routine weighings to 1 mg. The capacity is 200 g., sensitivity 0.2 mg. The Towers Model 100 Air-Damped Balance (Fig. 1) has a graticule divided to 10 mg., sub-divided in 0.1 mg. It is fitted with mechanically-operated fractional weights 10-500 mg., and the use of weights smaller than 1 g. is entirely eliminated. The

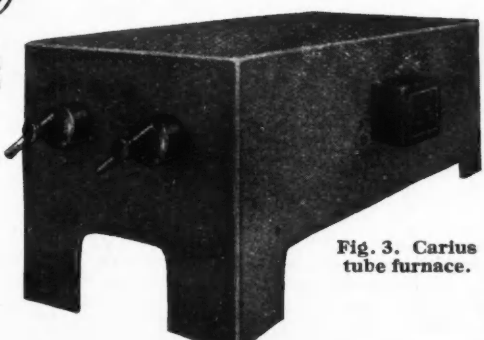


Fig. 3. Carius tube furnace.

mechanical fraction arrangement is robustly made, and has a smooth action. The weights added to the beam are read off on the rotating dial at the side. The balance has a capacity of 200 g., and is sensitive to 0.1 mg.

The Towers Laboratory Shaker (Fig. 2) is intended for general laboratory use; it is robust and quiet and has a most efficient action. In operation the carriage describes an arc giving a movement similar to hand-shaking, and any sediment is thrown vigorously from one end of the bottle to the other. The standard carriage is arranged to hold two Winchester quarts, or three 40-oz. bottles. The shaker provides a choice of three speeds, namely, 200, 250, or 300 strokes per minute, and the length of throw is adjustable from zero up to 2 in. maximum. The shaker is strongly built, ball-bearings, substantial castings, etc., being used throughout. All moving parts are enclosed by a sheet-metal cover for safety and cleanliness.

For those requiring high-speed agitation, the Towers Extra Rapid Shaker Model E has been designed, particularly for the bio-chemist, bacteriologist, and those engaged on chemotherapeutical research. It is an efficient means of mechanically disintegrating bacterial spores and vegetative forms—producing enzymes, etc.—by a process involving the vigorous agitation of fluid suspensions with finely divided abrasives. The normal highest speed is 430 strokes per minute with a throw of 3 in. Three carriers each accommodating four 2-oz. bottles can be housed on the reciprocating arm. Special carriers can be made to suit customers' requirements.

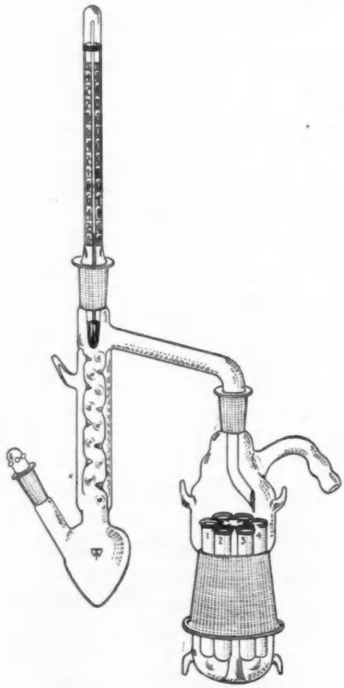
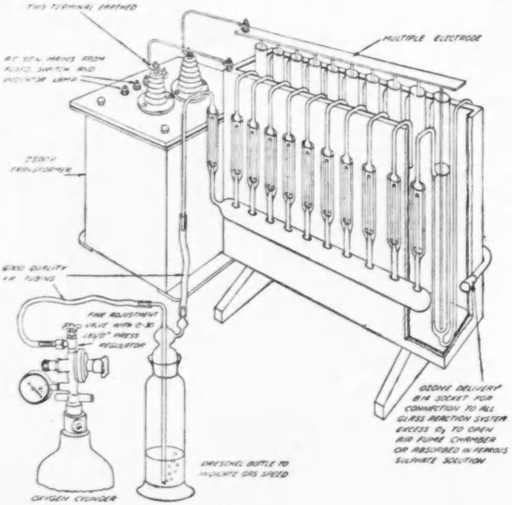


Fig. 5. Micro fractional distillation unit.



The Towers Electric Carius Tube Furnace (Fig. 3) is a compact and reliable furnace for use in the estimating of halogens by the Carius method. For this purpose electric heating is an advantage from the point of view of convenience and temperature control. The furnace is designed to accommodate two tubes and can be operated at any temperature from 50° to 360° C. The glass Carius tubes are enclosed in strong steel protector tubes with screwed end-caps. A control panel with ammeter, rheostat, fuses, and mains switch is supplied with each furnace. This enables the user to control the temperature accurately, and if a few tests are carried out the

Fig. 4 (left). Towers Ozone apparatus.

correct settings can be determined for any desired temperature. The furnace may be heated up rapidly to this temperature, which can then be maintained to within ± 10° C. if the control rheostat is readjusted until the meter reading corresponds with the predetermined setting. This arrangement obviates the need for the frequent checking of temperature common to most furnaces used for Carius work.

The oxidation of unsaturated compounds by ozone is always a possible need in the organic research laboratory. The Towers Ozone Apparatus (Fig. 4) provides a continuous supply of 170 cc. of ozonised oxygen per minute containing 6-7 per cent. ozone. The apparatus operates on the well-known principle of silent high-tension discharge (7500 v.) across an annular space through which oxygen is passing at a predetermined rate. The electrodes are continuously cooled by the weak electrolyte surrounding the annular space. The apparatus consists of 10 ozone units each with its own effective annular space, bridged in parallel across an inlet and outlet manifold. The apparatus is supplied complete with transformer with a secondary of 7500 volts.

Stainless Steel Funnels

Large Buchner funnels are essential in the manufacture of many pharmaceutical chemicals, and for semi-technical scale work. When porcelain or stoneware funnels are used heavy breakage from one cause or another is almost always experienced. The new stainless steel Buchner funnels overcome this continual expense, and justify their initial cost. The filter plate is flat, and has an ample number of holes for fast filtration. One standard size is made, 12 in. in diameter. They are also available with an outer jacket for steam or hot-water circulation for use where the liquid to be filtered must be kept hot during filtration.

Micro procedure is playing an increasingly important part in the field of practical organic and inorganic chemistry. During the past few years much new technique has been evolved and progress is steadily being made in the development and standardisation of micro apparatus. An example is the Towers Micro Fractional Distillation Unit (Fig. 5). This is designed for fractionating quantities of material from 0.5 to 5 ml. at atmospheric pressure or under vacuum, and may be operated safely up to 300° C. The unit consists of a pear-shaped distillation flask, to which is attached a Vigreux fractionating column enclosed in a highly-evacuated vacuum jacket. A thermometer with standard ground joint is fitted in the still-head, the side arm of which terminates in a standard ground cone with extension drip device. The distillate can be directed into any one of six numbered receiver tubes, which can be rotated as desired.

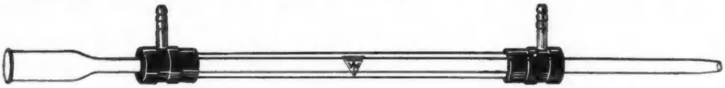


Fig. 6. "Longlife" condenser with moulded rubber connectors and brass side tubes.

The design of the ordinary Liebig condenser has changed little with time. In recent years there has been a tendency to decrease the annular width of the water jacket, and thus increase the rate of flow of cooling water with consequent increase in efficiency. One of the main troubles with Liebig condensers is the high rate of breakage due to the fragile nature of the side tubes. This trouble is now overcome in the Towers "Longlife" condenser (Fig. 6), which has inner and outer tubes fitted together by means of soft-moulded rubber connectors to which are fitted brass inlet and outlet tubes. The side tubes are therefore unbreakable and, in addition, the whole condenser is to a large extent protected from breakage as the rubber connecters act as cushions when the condenser is set down. These condensers are readily taken apart for cleaning; and all parts are interchangeable.

SOUND PIPE JOINTS

The following two specifications have just been issued by the British Standards Institution:

B.S. 1260, Jointing Paste for Flange and Similar Type Joints for Gas-heated Domestic Appliances and Gas Installation Pipes in Buildings. This specification is designed to ensure that the material complying with it will make sound joints with adequate protection against corrosion. No definite formula is given, but performance tests are laid down.

B.S. 1261, Jointing Compound for Screwed Joints for Gas-heated Domestic Appliances and Gas Installation Pipes in Buildings. This specification is similar to that above, except that it applies to compounds used for screwed joints, and therefore those suitable for brush application have been envisaged. A full range of tests is described.

These publications can be obtained on application to the B.S.I., 28 Victoria Street, London, S.W.1 (2s. each).

Czechoslovak Instrument Industry

Significant Developments Surveyed

(from a Special Correspondent)

AT a time when the future position of the British scientific instrument and optical industries forms the subject of lively discussion, it is of interest to note that, according to reliable information recently received in this country, remarkable progress has been made in these two industries in Czechoslovakia. During the war, productive capacity has greatly been increased with a simultaneous rise in the number of workers, and although a considerable reduction in the labour force has taken place since the war ended, it is still about two-thirds above the pre-war level. Also, since many workers became acquainted, during the war, with the most modern methods of production, their skill has increased considerably, leading to an all-round improvement of output. Another important factor that should enhance the competitive position of the instrument-making and optical industries is the absence of any war damage; while the change-over to peace-time conditions is almost completed.

Scientific apparatus for industry, dairies, distilleries, and sugar plants is being manufactured and a general increase in activities is expected because of the resumed production of many items which could not be made during the war. In addition, Czech manufacturers are anxious to enter the field of mass production in certain lines and active preparations are being carried out to that effect. The first products from the mass-production line which have already reached both domestic and foreign markets are chemical balances, spectacle lenses, field-glasses, and opera-glasses.

Nationalisation

The almost wholesale nationalisation in Czechoslovakia of companies employing over 500 hands has affected the instrument-making and optical industries to a relatively slight degree; nevertheless, about 60 per cent. of the trade has been nationalised; and the names of the firms concerned have been published in the *Official Gazette*. The nationalised sectors of these industries will come under the Organisation for Metal Working and Mechanical Industry, within which they will have their own representative. This organisation will be responsible for carrying out a general production plan and for the setting up of a central marketing organisation for the whole trade.

A considerable number of small highly specialised units remain under private ownership, and in order to assist their work, a special research institute has been set up, so that these relatively small firms will not have to establish their own research laboratories.

The supply of raw materials has not been as difficult as in other branches of the country's industry. It appears, however, that the most serious bottleneck occurred in the supply of optical glass, hitherto imported from Germany, France, and Great Britain. As regards other equipment and spare parts, formerly imported from Germany, Switzerland is reported to have stepped into the breach.

Export of scientific instruments and optical apparatus was a significant item in Czechoslovakia's pre-war foreign trade, and old connections in foreign markets are now being renewed on an increasing scale. In particular, orders for thermometers, laboratory equipment, microscopes and lenses have been received from the smaller European countries, such as Holland, Denmark, and Sweden. Moreover, in view of the large requirements, not merely in the industrialised countries of the Continent, which have been unable to renew their equipment during the war, but also in the less developed countries of South-Eastern and Eastern Europe, and the Near and Middle East, Czechoslovakia's scientific apparatus and optical industries are looking with confidence to the future.

Increasing demands and new developments in the paint, varnish, resin, and plastics industries call for plant of advanced design to cater for specialised products. Such plant is admirably illustrated and described in a timely list which is about to be issued by the London Aluminium Co., of Westwood Road, Witton, Birmingham, 6, who have had wide experience in catering for the industries mentioned. They now have in regular production reaction kettles, jacketed kettles, vacuum units, spray and tubular condensers, mixing units, storage tanks, etc., in mild steel, stainless steel, copper, aluminium, etc.

A means by which, it is claimed, iron or steel bodies of large size can be welded together at a minimum of cost, and in a manner ensuring adequate strength and rigidity at the bond, is provided by the "Thermit" welding process. This is described in detail in a pamphlet recently issued by Murex Ltd., Rainham, Essex, who are specialists in this field.

Swan Committee's Second Report

Suggested Amendments to Patent Act

by S. MITTLER, A.F.R.Ae.S., A.M.I.Mech.E.

THE President of the Board of Trade has recently presented to Parliament the Second Interim Report (on the Patents and Designs Acts) of the Swan Committee.* This report has been issued after taking the evidence of 38 persons or groups representing a cross-section of all those interested in the matter, *viz.*, inventors, manufacturers, industrial and professional associations, the Civil Service, the Bar, etc., to whom a detailed questionnaire had been sent at an interim stage of inquiry. The present report follows a First Interim Report† issued last year mainly on the procedure for the extension of term of patents where the patentee had suffered loss or damage as a consequence of the war, the recommendations of which have been partly adopted in the new Patent Bill.‡ The committee has now completed its inquiry.

The report consists of two main parts: the Prevention of Abuse of Monopoly Rights (paragraphs 7-66) and the Initiation, Conduct, and Determination of Legal Proceedings arising under or out of the Patents and Designs Acts (paras. 95-145), including the constitution of the appropriate tribunals, and of some interposed paragraphs (67-94) on the Registration of Patent Agreements and on the important question of inventive level which is referred to as "subject-matter" of inventions. A summary of main recommendations is given at the end of the report.

The recommendations are, on the whole, unanimous, with two members dissentient on the question of "subject-matter"; their minority views are contained in a postscript.

Preventing Abuse of Monopoly

After a historical excursus into the origin of the grant of patents for invention which are still based on the Statute of Monopolies, enacted in 1624, the report sums up the purpose of the Patents System to be as follows: To stimulate technical progress in four ways:—

(1) encouraging research and invention;
(2) disclosure of discoveries rather than keeping them secret;
(3) reward for expenses incurred in development of an invention; and
(4) inducement to invest capital in inventions.

The committee says that the history of industrial development has on the whole justified this theory, patent systems having been adopted by all industrial countries, including the Soviet Union, which, in addition, has developed a system of other rewards to inventors, appropriate to its particular economic system. The committee recommends in principle adherence to the present patent system which it considers also necessary if this country wishes to remain a member of the International Union for the Protection of Industrial Property. The report then deals with the obligations of a British patentee in regard to working his invention and to grant licences under the present Act, and with the allegations frequently made that restrictive use of patent rights is made in spite of the provisions of the Act, and then discusses some remedies suggested to the committee.

No Universal Licences

The universal adoption of Licences of Right is not recommended, as this would reduce a patent to a right to receive royalties. The incentive for the investment of capital would be weakened if there were no period of exclusive right of use, and the payment of such royalties might be preferred to the toil and risk of research and development. Those who did undertake that risk would then prefer to work their inventions in secret. The weeding out of patents of doubtful validity through legal action would be replaced by the less risky and expensive process of obtaining a licence, and this again would not be in the public interest.

The alternative proposal of postponement of compulsory licences until after the first half of the term of a patent, and then only if the patentee has not worked the invention to the satisfaction of the Comptroller, is rejected because it would throw an intolerable burden on the Patent Office if carried out properly, or would degenerate otherwise to a mere formality. Similar objections apply to the suggestion to reduce the normal term of a patent to, say, ten years, after which the patent would either lapse, continue with the endorsement of licences of right, or without such endorsement on satisfactory proof of "working."

The suggestion that the provisions of Section 38A(3), *i.e.*, instructing the Comptroller to grant a licence to any applicant unless he sees good reason to the contrary (which at present refers to food and medicine only), should be extended to all patented inventions, is also turned down on the ground that this section does not give any indication to the Comptroller as to the

* H.M.S.O., Cmd. 6789, April, 1946.
† Cmd. 6619, *see* THE CHEMICAL AGE, 1945, *53*, 54.
‡ THE CHEMICAL AGE, 1946, *54*, 337.

reasons which should decide whether or not a licence should be granted.

Proposals for Amendment

Section 27 of the Act should be extended, the committee proposes, to provide for the grant of licences even if no actual abuse of monopoly rights has taken place, but where a more extended use of a patent could be made, such as where a patentee is exploiting a patent to the full extent of his ability but where there are still other uses of the invention, or potential demands for the patented article, unfulfilled, or where the patentee fully supplies the home market, but fails to supply the export market. Another case for a compulsory licence would be an invention of a subsequent inventor which could not be worked without the use of an earlier patent.

The committee suggests in Appendix ii the redrafting of sub-sections 1 to 6A of Section 27 of the Act to put these proposals into effect and to give the Comptroller a freer hand to use his discretion which should be merely guided, not fettered, by the following considerations: (1) fullest possible working for home and export market; (2) reasonable remuneration of patentee and fairness to existing licences; (3) lowest possible price for food, medicine, and surgical devices; (4) the ability of an applicant for a licence to work to the public advantage; (5) measures taken by patentee or any licensee to make full use of the invention; and (6) the risk incurred by applicant for a licence in providing capital if licence is granted.

An application should be decided on the state of conditions at the time of making such an application, in order to prevent the patentee from evading a licence by any working after that date. Section 38A(3), rendered superfluous by the above amendments, should be repealed.

Registration of Agreements

The fullest possible publicity of patent agreements is thought by the committee to be in the public interest. While the registration of assignments (Section 71 of the Act) is on the whole considered satisfactory, that of licences is not. However, the committee does not recommend the introduction of fines, etc., because of the serious difficulties standing in the way of enforcing them. It is considered desirable to lay the deeds of agreement open to public inspection, but in view of the fact that patent clauses sometimes form only a small part of extensive business transactions and that there is no universal obligation yet for the disclosure of all commercial documents, the committee is of opinion that documents containing references to patent agreements should not be singled out for such treatment.

At present the official examination in this country is, apart from investigation of novelty, limited to whether an invention constitutes a "manner of new manufacture" under the Statute of Monopolies, 1624. In the patent systems of other countries such as the United States or most of the Central and North European countries, the Patent Offices have the power to consider also the inventive level, *i.e.*, the "subject-matter" of a patent application, which is believed to increase the value of these patents as compared with that of British patents. The committee recommends, with two dissentients, the introduction of this system into the official examination (Section 7), into the grounds for opposition (Section 11) and of "belated opposition" (Section 26); with the proviso that rejection on the ground of lack of subject-matter should take place only after the case has been heard by two hearing officers sitting together and arriving at a unanimous decision. The Comptroller should also have power to refuse a patent in lieu of inserting a reference to a prior specification if the applicant fails to amend his specification.

Lack of novelty because of prior user is not recommended as a new ground for refusal in the course of the official examination under Section 7, but should be introduced as a ground of opposition (Section 11) or "belated opposition" (Section 26). The committee is, however, against the adoption of "lack of utility" as a ground for refusal, beyond the existing provisions of Section 2, sub-section 5 of the Act prescribing the furnishing of samples for chemical inventions.

Appeals from the Comptroller

The committee recommends that all appeals should be vested into the Appeal Tribunal, including those at present going to the court, arising out of Sections 20, 21, 24, 26, 27, 37 and 38A. In the case of "belated opposition" and of refusal because of "lack of subject-matter," appeal to the High Court should be open if leave is given by the Judge presiding over the Appeal Tribunal. Instead of a petition requiring an elaborate document and counsel, notice of appeal to the tribunal could then be given by applicant himself, his solicitor or patent agent, on a form stamped £3. On the other hand, a free hand should be given to the Appeal Tribunal in assessing costs by removing from Section 92A(3) the reference to the practice before the Law Officer prior to the setting up of the Appeal Tribunal.

Trial of Patent Actions

The committee endorses the views expressed by many witnesses that the present procedure is too complicated and expensive. It recommends the appointment of two special Judges, possessing technical or scientific qualifications and experienced in patent

litigation, to hear all patent actions, one of them being included in the Court of Appeal when appeal is lodged against a decision of the other. Either of these Judges should be available to act as the Patents Appeal Tribunal Judge. Scientific advisers should be available for the assistance of the Judge in all patent actions. Restrictions on the evidence of an expert witness should be removed so as to enable him to express an opinion as to the meaning of the patent specification as a whole and not only of particular words or phrases.

Costly and perhaps unnecessary experiments should be restricted by requiring the party desiring to rely on experiments to furnish the other side with a statement of the facts to be established, and by placing the costs of the experiments on the party requiring them. The practice of interchanging signed statements which was thought to bring about simplification of procedure is considered to have had the contrary result and is therefore recommended to be discontinued.

The committee takes up the recommendation made already to the Sargant Committee in 1931 to introduce—by agreement *inter partes*—the trial of actions involving the issues of infringement and of validity before the Comptroller, whose decision should be final but limited to the award of costs not exceeding £1000. The Comptroller should not have power to grant relief by injunction or to deal with interlocutory applications. His decision should not debar either party from taking such proceedings in the High Court as may be open under the existing law by way of action for infringement or petition for revocation. It is, however, believed that comparatively few cases would be brought before the Court where the less expensive procedure before the Comptroller is available.

Dissentients' Proposals

The two dissentient members state their reasons against the introduction of the ground of "lack of subject-matter" into the official examination and to a lesser degree into the grounds for opposition and "belated opposition," and wish to establish the right of appeal to the Court on a certificate, from the Judge presiding over the Appeal Tribunal, that issues of subject-matter are involved.

At the annual general meeting of the F.B.I., held in London on April 17, Sir Clive Baillieu (who is at the moment in the United States on a short business trip) was elected president of the Federation for a second year.

German Technical Reports

Details from Latest List

APPENDED are details from the latest list of industrial reports by the Combined Intelligence Objectives Sub-committee (CIOS) and the British Intelligence Objectives Sub-committee (BIOS).

CIOS XVI—4, 5, 8. *Belgian plastics Industry* (2s. 6d.).

CIOS XVIII—5. *Synthetic Lubricating Oil Production in France* (1s.)

CIOS XXV—2. *Luftfahrtforschungsanstalt Hermann Goering, Volkenrode, Brunswick*: Chemical work at motor and weapon research institutes (1s. 6d.).

CIOS XXVI—64. *I.G. Farben, Oppau*: Manufacture of hydrocyanic acid (6d.).

CIOS XXVII—60. *The Wesselring Synthetic Fuel Plant* (13s. 6d.).

CIOS XXVII—94. *Vereinigte Deutsche Metallwerke A.G.*: Description of plant manufacturing semi-finished forms of alloy and non-ferrous metals (2s.).

CIOS XXVIII—27. *Leuna Works, near Merseburg*: Methanol, methylamine, synthetic detergents, ethylene, hydrogenation of coal, butane to butene, alkylation process (1s.).

CIOS XXVIII—28. *I.G. Farben, Wolfen Works*: Nitrochlorobenzene, paranitraniline, hydroquinone, chlorobenzene (1s.).

CIOS XXX—93. *Fried. Krupp A.G. Blankenburg*: Foundry technique, melting practice and metallurgical control of plant (1s. 6d.).

CIOS XXXIII—5. *The methanisation of coal gas. Information obtained from Dr. Martin, of Ruhrchemie A.G., and Dr. Traenckner, or Ruhrgas A.G.* (1s.).

CIOS XXXIII—24. *Report on investigations by fuels and lubricants team at the Brabag Works, at Troglitz, Zeitz*: Hydrogen production. Hydrogenation (2s. 6d.).

BIOS 247. *German chemical plant with particular reference to centrifuges* (2s.).

BIOS 271. *German dyestuffs and intermediates*: Sodium hydrosulphite, sodium sulphoxylate (2s.).

BIOS 279. *German technique in the production of light alloys* (3s.).

BIOS 282. *German casein plastics industry* (7s.).

BIOS 290. *The viscose continuous and rayon staple fibre plants of the British, American and French occupation zones of Germany* (30s.).

BIOS 306. *The manufacture of caffeine and theophylline in U.S. and French Zones* (1s. 6d.).

BIOS 311. *Production of aluminium sulphate, Giulini* (6d.).

BIOS 316. *German light alloy foundry industry* (2s.).

A CHEMIST'S BOOKSHELF

Annual Reports on the Progress of Applied Chemistry, 1944. Vol. XXIX. London: Society of Chemical Industry. Pp. 570. 20s.; to members, 11s. 6d.

To readers of The Chemical Age, a review of the "Annual Reports" is almost a matter of form. The standard of the collected information is so remarkably consistent, and the general indispensability of the volume so universally acknowledged, that it becomes a matter of recording rather than criticising.

The overwhelming preponderance of references to American literature and patents is rather less noticeable, and a welcome feature is the increasing number of references to continental European journals.

Several new authors make their appearance in this volume, most notable being the substitution, in the section on Acids, Alkalis, and Salts, of the South Metropolitan gas team (P. Parrish and F. C. Snelling) by a group from I.C.I. (I. L. Clifford, J. Manning, S. W. Rowell, C. W. James). These last were assigned a difficult task in following on after two such distinguished experts, but they have carried out the job with full efficiency. The same can be said of Dr. Hill and Dr. Howlett, of the British Cotton Industry Research Association, who have succeeded Messrs. Battye and Marsh (Tootal Broadhurst Lee Co., Ltd.) in the sub-section on Cellulose Textile Chemistry.

The year under review being still a war year, a certain amount of information has had to remain under the seal of secrecy, but there are already stirrings, and some interesting references to post-war plans are included. A considerable increase in the section dealing with Resins, Paints, etc., indicates the great attention that has been given lately to the chemistry of polymerisation. For similar reasons, the chapter, or rather chapters, on Plastics continue to occupy the largest space in the report.

It would be invidious to single out any section for special praise; the workmanlike arrangement and the clarity of the volume as a whole continues to make it an indispensable tool for every chemist.

Thorpe's Dictionary of Applied Chemistry, 4th Ed., Vol. VII (Iodazide-Metellagic Acid). Edited by Dr. M. A. Whiteley *et al.* London: Longmans. Pp. 629. 80s.

This is the first volume of "Thorpe" to be issued under the guidance of the Editorial Board founded in 1941. Dr. Martha Whiteley continues as editor, with Dr. A. J. E. Welch as assistant editor. The editorial board consists of Sir Ian Heilbron (chairman), Dr. H. J. Emeléus, Dr. H. W. Melville, and Dr. A. R. Todd. The pious hope expressed in the foreword of Vol VI, that the remaining volumes might be published yearly, has been falsified; it is unlikely that this is the fault of the editors, and the same may be said of the rather astonishing contrasts in the printing-paper employed.

To review such a work really adequately would demand a super-encyclopædic knowledge not only of chemistry but of industrial chemical technology. Let it be briefly stated, then, that this volume is in all practical respects the equal of its predecessors: that is to say it is an indispensable adjunct to every industrial chemical laboratory. The slightly increased stress laid on the physical side of chemistry makes it invaluable to chemical engineers also.

Metals lead the way among the major articles in the present volume, with the late Dr. W. H. Hatfield on *Iron and Steel*, Dr. J. A. Smythe on *Lead*, Professor C. O. Bannister on *Magnesium* and *Manganese*, and Professor J. H. Andrew on *Metallography*. The important section on *Ketones* is by Professor J. T. Hewitt, and the late Professor T. J. Nolan has contributed an interesting and unexpectedly long discussion on *Lichen Substances*. The assistant editor deals with the *Liquefaction of Gases* and with *Lithium*, while the important subject of *Iodine* is in the excellent hands of Dr. F. C. Kelly, director of the Iodine Educational Bureau. This sort of catalogue might be extended indefinitely. The success of the editors in obtaining the collaboration of leading authorities is indicated (*e.g.*) by 24 articles on minerals from the pen of Dr. L. J. Spencer; 18 by Mr. A. G. Pollard on fruits and vegetables, familiar and exotic; and 14 pages about leather chemistry by Dr. Dorothy Jordan-Lloyd. Dr. J. N. Goldsmith has continued his valuable index.

A first glance has revealed but few errors: we have noted "Asturia" for Asturias on p. 81 (*d*); "in" for "is" on p. 372 (*b*), l. 37; while something has gone wrong with the *umlaut* over Löss on p. 377.

Qualitative Inorganic Microanalysis. By R. Belcher and C. L. Wilson. London: Longmans, Green. Pp. 68. 2s. 6d.

This modest volume, described as "a short elementary course," is the work of two experienced authors, and performs quite admirably the task on which it sets out. It confines itself to the essentially practical, and successfully achieves, in our opinion, the elimination of the belief that micro methods of analysis are beyond the manipulative power of students with little knowledge of practical chemistry. The section on apparatus is copiously and clearly illustrated, as it should be; the section on manipulative technique shows there is nothing unduly fearsome in that branch of the subject; and the tests are set out plainly and straightforwardly. An excellently clear little manual.

Parliamentary Topics

Science in the 1951 Exhibition

IN the House of Commons last week, Mr. Janner asked the President of the Board of Trade whether, in setting up the committee to organise the Great Exhibition of 1951, he would ensure that science would be adequately represented. Mr. Marquand, replying, said that no decision had yet been taken upon the form of the administration of this exhibition, but whatever form it took he could assure the questioner that science would be represented.

Alkali

Colonel Clarke asked the President of the Board of Trade what effect the reduction in the supply of fuel to the alkali factories of I.C.I., in the N.W. region, had had on the export trade in alkalis and on the price to the home consumer.

Mr. Belcher: Production of alkalis was curtailed towards the end of January owing to insufficiency of coal supplies, and exports during February and March fell below programme by about 34,000 tons. I am informed that, as from April 1, I.C.I. have withdrawn certain price concessions to home consumers who purchase on contract terms, the effect being to increase the cost to such consumers by about 5 per cent.

Colonel Clarke subsequently asked the Minister of Fuel and Power why the allocation of fuel to the I.C.I. alkali factories in the N.W. region was reduced from January last; and for how long these rates would operate.

Mr. Shinwell said that existing coal supply arrangements were designed to spread available supplies equitably to all industrial consumers, and the I.C.I. factories had been getting their fair share on this basis. He was aware that I.C.I. had experienced some difficulty as regards exports because of the shortage of coal, but if there was a shortage they must obviously allocate it on the basis of suitable priority.

British Dyes

Mr. Titterington asked the President of the Board of Trade what approximate percentage of dyes used in this country came from Germany before the war; what percentage was now produced in this country; whether he was satisfied as to the dependability and quality of these dyes, and whether instructions would be issued to his department to publicise the present satisfactory position.

Mr. Belcher said it was estimated that approximately 13 per cent. by weight of the dyestuffs used in the United Kingdom before the war were imported, the proportion from Germany being about 9 per cent.; and that at present over 95 per cent. of U.K. usage of dyestuffs is from home production. Users of U.K. dyestuffs had expressed appreciation of the range and quality of the British dyes produced during the war, but he did not think it necessary for the Board of Trade to take special measures to publicise their satisfactory quality.

Scientific Instruments

In reply to a question from Mr. Blackburn, the Minister of Supply stated that in view of the shortage of scientific instruments Government departments had recently been asked to make a special review of their holdings of such equipment. The duties connected with the disposal of scientific instruments fell to his own Ministry.

Agricultural Potash

Mr. De la Bère asked the President of the Board of Trade the comparative figures of imports and stocks of potash for agricultural purposes this year as compared with 1944-45.

Mr. Belcher: The comparative figures, in terms of K_2O, are as follows:—

	1944/5 Tons
Opening stocks at July 1, 1944	14,847
Imports to March 31, 1945	87,407
Opening stocks plus imports to March 31, 1945	102,254

	1945/6 Tons
Opening stocks at July 1, 1945	3,270
Imports to March 31, 1946	89,786
Opening stocks plus imports to March 31, 1946	93,056

No stocks were held at the end of March in either year, all imports at this time of the season going direct to compounders or distributors.

Lead Prices

Sir G. Fox asked the Minister of Supply the present world price of lead; the latest price paid for supplies by the Government; the quantity purchased and the date the purchase was made.

Mr. Leonard replied that there was no recognised world price for lead at the present time. Prices for current supplies were now under negotiation with the producers; those paid by the Government for supplies during the latter part of February and March, covering 24,000 tons, were based on a price of 7 cents per lb. (approximately £39 per ton) f.o.b. port of shipment to this country.

MR. ARTHUR HACKING has been appointed chairman of the British Match Corporation, Ltd., in succession to the late Sir Clarence E. Bartholomew. THE HON. HUGH K. M. KINDERSLEY has been elected a director and appointed deputy chairman. MR. H. O. AGRELL and MR. JOSEPH H. G. REED have been appointed joint managing directors.

General News—From Week to Week

Two employees were injured by an explosion on April 17 in the experimental and research laboratory of Messrs. Smith and Shaw, research chemists, Cavendish Place, London, W.

An Ayrshire branch of the A.Sc.W. has been formed, drawn largely from I.C.I. staffs in the area. The hon. president is Mr. Stuart Patterson, of Ardrossan, and the chairman Mr. A. L. Wilson.

Steel production in Great Britain during March was at an annual rate of 13,295,000 tons—the highest ever achieved in peace time and very near the peak production of the war years.

Having received the assent of the Iron and Steel Federation to the publication of their report, Mr. Wilmot, Minister of Supply, has announced his intention of arranging for its issue as a White Paper as soon as possible.

The latest issue of "Iodine Facts" by the Iodine Educational Bureau, Stone House, Bishopsgate, London, E.C.2, is devoted entirely to a comprehensive survey of the world-wide problem of goitre.

The corrugated iron sheet industry has returned to Widnes, where the Birmingham Corrugated Iron Co., Ltd., established in 1912, has come into action again, after having been diverted to other manufacturing processes during the war.

Thieves are thought to have been responsible for a fire which damaged the paint store of Silexine, Ltd., Richford Street, London, W.6, early on Wednesday morning. Police summoned by the firemen found that carpets had been removed from the offices.

The total amount of tin used by the United Kingdom in 1945 was 24,913 tons, while apparent American consumption in that year is estimated at 58,000 tons, according to the International Tin Research and Development Council.

A further memorandum on electrodeposition, now released by the Ministry of Supply, is "Machining Before and After Repair by Electrodeposition," copies of which may be obtained from The Secretary, Electrodeposition Technical Advisory Committee, c/o S.T.A.M., 623 Berkeley Court (S.W. Wing), Glentworth Street, London, N.W.1.

The current issue of *Endeavour* (April, 1946) contains interesting articles on the development of paludrine, by Dr. F. L. Rose, and on mineral deficiencies in plants by Professor T. Wallace, as well as the customary rich allowance of material on other aspects of British science—notably a history, by Professor J. Kendall, of the Royal Society of Edinburgh from 1783 to 1946.

When fire broke out at the premises of G. C. Hurrell & Co., Ltd., chemical plant manufacturers, Woolwich Road, Woolwich, last week, flames damaged the roof and part of the contents of a large single-storey building.

Glasgow students, taking chemistry courses at the Royal Technical College, Glasgow, are to meet the Ministry of Labour to discuss their release from industry to resume their studies. When manpower was acute they were directed to work in various essential industries.

Explanatory notes just published in booklet form by the Board of Inland Revenue relate to income tax allowances for industrial buildings; income tax allowances for machinery or plant; and patents and income tax. The booklets are No. 410, No. 430 and No. 490 respectively.

Glasgow Dean of Guild Court have granted permission to Fibreglass, Ltd., to demolish their factory at Possilpark, Glasgow, and build a three-storey steel-and-brick factory on the site. The alteration will involve no stoppage of work in the factory, and, when it is completed, the firm will extend considerably.

The Trading with the Enemy (Specified Persons) (No. 15) Order, 1946 (S.R. & O. 1946, No. 529), contains 35 additions to the list of firms, etc., with whom relations of any kind are unlawful. The list includes Industrias Quimicas Reunidas S.A. (Inquiresa). and Cloratita S.A., both of Barcelona; and Berndorfer Metallwerk A.G., Lucerne.

Nearly 1450 million gallons of light hydrocarbon oils were retained for home consumption in the eleven months ending February 28 last (including 10,000 gallons of heavy oils for mixing); also 109.7 million gallons of heavy oils for road-vehicle fuel (duty paid as for light oils); and 708.6 million gallons of heavy oils (duty paid at 1d. per gal.). These figures were supplied last week by the Chancellor of the Exchequer in answer to a written question from Mr. Erroll.

In the grand total of supplies sent to the U.S.S.R. between October 1, 1941, and March 31, 1946, the following items were included among raw materials, according to a statement made in Parliament by the Prime Minister: aluminium from Canada, 30,000 tons (£3,038,000), from the U.K., 2000 tons (£720,000); copper from Canada, 27,000 tons (£1,431,000), from the U.K., 13,000 tons (£773,000); tin from the U.K. and Malaya, 28,050 tons (£7,774,000); graphite from Ceylon, 3300 tons (£160,000).

Consumption of virgin copper in the U.K. in March amounted to 24,920 tons (21,790 in February), according to the British Non-Ferrous Metals Federation, making 74,470 tons for the first quarter of 1946. Higher copper sulphate output absorbed 1280 tons of copper, against 990 in February.

The drift south to England of wartime industries and the necessity for scientific and research personnel to follow from Scotland, was deplored by Mr. Roy Innes, general secretary of the A.Sc.W., when he spoke in Edinburgh last week. He said the calcium carbide and calcium cyanamide industries in Scotland could be developed and lead to the development of other industries such as synthetic rubber and plastics.

Foreign News

Under a Polish-Rumanian trade agreement, the first shipment of oil and manganese has arrived in Poland in exchange against coal.

Belgium's cast-iron production amounted to 274,280 tons in 1945, while her steel production totalled nearly 300,000 tons.

Bauxite, pharmaceutical goods, oil and its derivatives, as well as precision instruments, will be exported from Hungary to Poland in exchange for coal, coke and salt.

The export of phosphate fertiliser from Belgium has been prohibited until further notice in order to conserve supplies for the country's agriculture.

Canada's magnesium output declined from 10.6 million lb. in 1944, to 7.4 million lb. in 1945. New uses are being found, especially in aluminium alloys and in structural metals.

Italy is to supply chemical products, machine tools, and sulphur to Yugoslavia in exchange for material for reconstruction purposes under a barter agreement signed recently.

Danish pharmaceutical and metallurgical products, etc., to the value of 75 million kroner, will be exchanged for Finnish timber products, faïence and porcelain under a trade agreement recently signed between the two countries.

The following Czechoslovak chemical and pharmaceutical enterprises have recently been nationalised: "Synthesia" Chemical Works, Semtin; the Association for Chemical and Metallurgical Production, Prague; and the Ostrava Chemical Works in Moravska Ostrava.

The nylon plant of the Montecatini group at Verbania, started before Italy's entry into the war on a pilot basis, is to be expanded to commercial production. Relations with the Du Pont group, which had granted a licence for the pilot plant, have been resumed, and it is expected that the American company will provide such technical and other assistance as may become necessary.

Forthcoming Events

April 30. Institute of Fuel. Rooms of the Geological Society, Burlington House, Piccadilly, London, W.1, 10 a.m. and 2.30 p.m. Conference on Industrial "Waste Heat" Recovery (see THE CHEMICAL AGE, April 13, p. 390).

May 1. Institute of Fuel (Midland Section). James Watt Memorial Institute, Birmingham, 2.30 p.m. Mr. O. Lyle: "Inefficiency."

May 1. Society of Public Analysts. The Chemical Society's Rooms, Burlington House, Piccadilly, London, W.1, 6 p.m. Dr. E. C. Barton-Wright: "The Microbiological Assay of Amino Acids: I. The Assay of Tryptophan, Leucine, Isoleucine, Valine, Cystine, Methionine, Lysine, Phenylalanine, Histidine, Arginine, and Threonine." Dr. E. C. Barton-Wright and Dr. T. Moran: "The Microbiological Assay of Amino Acids: II. The Distribution of Amino Acids in the Wheat Grain."

May 1 and 2. Iron and Steel Institute. 4 Grosvenor Gardens, London, S.W.1. Annual general meeting. May 1: 9.45 a.m., official business and discussion on "Fuel Economy in Iron and Steel Works": 2.30 p.m., continuation of discussion and further discussion on "Supersonic Testing": 8.30 p.m., first Hatfield Memorial Lecture, Dr. G. B. Waterhouse (at Institution of Civil Engineers, Great George Street, S.W.1). May 2: 9 a.m., dicussion on "The Overheating of Steel."

May 2. Royal Statistical Society (Industrial Applications Section, Sheffield Group). Sheffield University, 6.30 p.m. Mr. F. C. Lawrence: "Costs, Overhead Expenses and Effort Assessment in Practice."

May 6. Society of Chemical Industry (London Section). Rooms of The Chemical Society, Burlington House, Piccadilly, S.W.1, 6.15 p.m. Annual general meeting.

Company News

Bryant & May, Ltd., report net profit for the year ended March 31, totalling £404,807 (£399,706). Final ordinary dividend 10½ per cent. (same), making 18½ per cent. (same).

Sternol, Ltd., report dividend of 12 per cent. on the preferred cumulative ordinary shares covering the remaining half-year's arrears of 1940, and the whole of 1941 arrears.

Borax Consolidated, Ltd., is paying an interim dividend of 3 per cent., less tax, on the preferred ordinary stock, on June 1, in respect of the financial year ending September 30, 1946.

British Lead Mills, Ltd., report profit for the year to October 31, totalling £32,200 (£28,663). Dividend. 30 per cent. (10 per cent.).

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

ERNEST HINCHLIFFE LTD., Sheffield, iron and steel merchants. (M., 27/4/46.) March 29, debenture to Mosley Street Nominees, Ltd., securing all moneys due or to become due to Williams Deacon's Bank, Ltd., from the company; general charge. *Nil. December 31, 1945.

New Companies Registered

Kolmyne Products, Ltd. (408,389).—Private company. Capital, £100 in £1 shares. Manufacturers of and dealers in chemicals and chemical products, etc. Directors: J. H. Harrison; F. Harrison. Solicitors: Parker Rhodes & Co., Rotherham.

British Coria Co., Ltd. (408,300).—Private company. Capital, £100 in £1 shares. Manufacturers of and dealers in plastic, synthetic and chemical materials and substances, etc. Directors: C. A. Goatcher; P. L. Freret. Registered office: 45 Isledon Road, London, N.7.

Chemical and Allied Stocks and Shares

DESPITE the speculative activity in Orange Free State gold mining shares, business in other sections of stock markets remained on a substantial scale, with British Funds again higher on balance and further widespread gains in industrial shares. The main stimulus in regard to industrials was again hopes of future benefits from the abolition of E.P.T. Moreover, financial results coming to hand have created an excellent impression, bearing in mind that following the higher profits reported by I.C.I., J. & P. Coats have announced an increased dividend which exceeded expectations. Markets remained in an optimistic frame of mind and are not disposed to pay much attention to politics and international affairs. Nevertheless the Government's nationalisation decision in regard to the iron and steel industry came as a shock, resulting in all-round declines in this section, ranging from 6d. to 2s. The announcement caused great uncertainty because the industry is left in the dark as to which sections of its widespread activities are to be nationalised.

Imperial Chemical have been prominent on further consideration of the past year's figures, and advanced to 42s. 6d., while Turner & Newall rose further to 88s. 9d., Lever & Unilever to 53s. 9d., Borax Consolidated deferred to 46s., and United Molasses to 54s. 6d. British Aluminium, at 37s. 7½d., rallied further on hopes that the lower metal price will stimulate demand for aluminium, and Imperial Smelting have been active around 18s. 9d. Paint shares were featured by general improvement under the lead of Pinchin Johnson 10s. ordinary, which advanced strongly to 42s. on the higher dividend; International Paint were 126s. 10½d., and British Paints 57s. 6d. B. Laporte held their advance and marked 91s. 6d. Recognition of the scope for expansion of the fertiliser industry drew more attention to Fisons' shares, which were dealt in up to 58s., while Cooper McDougall & Robertson marked 35s. 9d. Greeff-Chemicals Holdings 5s. shares also received more attention up to 11s. 6d. The Lacrinoid Products results tended to draw more attention to shares of companies with plastics interests. Lacrinoid 2s. shares were firm at 7s., De La Rue £11¼, Erinoid 5s. ordinary 13s. 1½d., and British Industrial Plastics 2s. shares have been active around 8s.

Reflecting the uncertainty arising from the Government's nationalisation announcement, Dorman Long were no better than 23s. 9d., Guest Keen 42s. 6d., Hadfields 26s., Colvilles 23s. 9d., United Steel 21s. 4½d,. and Vickers 19s. 10½d., while Thomas & Baldwins 6s. 8d. shares fell back to 10s. Later, the lower prices tended to attract a little buying. It is felt that at current levels some iron and steels may be considerably undervalued; but until it is known which sections of the industry are to be nationalised it is impossible to form definite views in regard to individual shares.

Boots Drug strengthened further to 60s. Beechams deferred were good at 24s. on calculations as to E.P.T. abolition benefits, but Griffiths Hughes receded to 55s. 7½d. British Drug Houses remained prominent among "E.P.T. shares," changing hands around 63s. Textiles were favoured, partly on the higher J. & P. Coats dividend, and partly because if E.P.T. had been retained it would, in many cases, have borne very heavily on future earnings. Bradford Dyers moved up to 26s. 6d., Calico Printers to 24s. 3d., and Bleachers to 13s. 3d., while there was a sharp rebound to 54s. 4½d. in Courtaulds. Oils were firm and featured by a rally in Anglo-Iranian.

Prices of British Chemical Products

A STEADY resumption of activity after the interruption of the Easter holiday is reported from most sections of the market for general chemicals. Contract deliveries and replacement orders are on a good scale and a substantial export inquiry continues. There are no important price changes to record and the position of the soda products and potash compounds remains steady with quotations firm at recent levels. The demand for the white and red leads continues steady at the dearer rates, while offers of citric and tartaric acids are likewise quickly taken up. Business in coal-tar products has been moderate. In most cases producers are committed to forward contracts although spot offers of toluol and xylol have been in evidence. The naphthalenes are firm and in short supply.

MANCHESTER.—The past week has seen the Manchester market for both light and heavy chemical products pronouncedly under the influence of the holiday conditions and this has been reflected as much in the movement of contract supplies of textile and other industrial chemicals as in the volume of new business. It is understood, however, that substantial bookings are pending with home trade users, and plenty of inquiries covering additional export business are expected. The undertone of the market is firm throughout. Most classes of fertilisers are being taken up in good quantities.

GLASGOW.—Business in the Scottish heavy chemical market was to a certain extent curtailed during the past week by the incidence of the Easter holidays. At the same time, a firm demand in all classes of chemicals in the home market was expected, with prices tending to harden. A steady volume of inquiry is also passing in the export market, with considerable interest shown in formaldehyde, zinc oxide, and all classes of solvents, but it is by no means possible to meet the existing demands. Shipping space remains a problem and completion of outstanding orders is seriously affected by lack of space.

Price Changes

Rises: Lead, red; lead, white; oxalic acid (London and Manchester); zinc oxide; pitch (Manchester).

General Chemicals

Acetic Acid.—Maximum prices per ton: 80% technical, 1 ton, £47 10s.; 80% pure, 1 ton, £49 10s.; commercial glacial, 1 ton, £59; delivered buyers' premises in returnable barrels, £4 10s. per ton extra if packed and delivered in glass.

Acetone.—Maximum prices per ton, 50 tons and over, £65; 10/50 tons, £65 10s.; 5/10 tons, £66; 1/5 tons, £66 10s.; single drums, £67 10s.; delivered buyers' premises in returnable drums or other containers having a capacity of not less than 45 gallons each. For delivery in non-returnable containers of 40/50 gallons, the maximum prices are £3 per ton higher. Deliveries of less than 10 gallons free from price control.

Alum.—Loose lump, £16 per ton, f.o.r. MANCHESTER: £16 to £16 10s.

Aluminium Sulphate.—Ex works, £11 5s. per ton d/d. MANCHESTER: £11 5s. to £11 10s.

Ammonia, Anhydrous.—1s. 9d. to 2s. 3d. per lb.

Ammonium Bicarbonate.—MANCHESTER: £35 10s. per ton d/d.

Ammonium Carbonate.—£37 10s. to £38 per ton d/d in 5 cwt. casks. MANCHESTER: Powder, £38 10s. d/d.

Ammonium Chloride.—Grey galvanising, £22 10s. per ton, in casks, ex wharf. Fine white 98%, £19 10s. per ton. See also Salammoniac.

Ammonium Persulphate.—MANCHESTER: £5 per cwt. d/d.

Antimony Oxide.—£110 to £117 per ton.

Arsenic.—Per ton, 99/100%, £26 10s. for 20-ton lots, £31 for 2 to 10-ton lots; 98/99%, £25 for 20-ton lots, £29 10s. for 2 to 10-ton lots; 96/99% white, £21 15s. for 20-ton lots, £25 15s. for 2 to 10-ton lots.

Barium Carbonate.—Precip., 4-ton lots, £19 per ton d/d; 2-ton lots, £19 5s. per ton. bag packing, ex works.

Barium Chloride.—98/100% prime white crystals, 4-ton lots, £19 10s. per ton, bag packing, ex works.

Barium Sulphate (Dry Blanc Fixe).—Precip., 4-ton lots, £18 15s. per ton d/d; 2-ton lots, £19 10s. per ton.

Bleaching Powder.—Spot, 35/37%, £11 to £11 10s. per ton in casks, special terms for contract.

Borax.—Per ton for ton lots, in free 1-cwt. bags, carriage paid: Commercial, granulated, £30; crystals, £31; powdered, £31 10s.; extra fine powder, £32 10s. B.P., crystals, £39; powdered, £39 10s.; extra fine, £40 10s. Borax glass, per ton in free 1-cwt. waterproof paper-lined bags, for home trade only, carriage paid: lump, £77; powdered, £78.

Boric Acid.—Per ton for ton lots in free 1-cwt. bags, carriage paid: Commercial, granulated, £52; crystals, £53; powdered, £54; extra fine powder, £56. B.P., crystals, £61; powder, £62; extra fine, £64.

Calcium Bisulphide.—£6 10s. to £7 10s. per ton f.o.r. London.

Calcium Chloride.—70/72% solid, £5 15s. per ton, ex store.

Charcoal, Lump.—£15 to £16 per ton, ex wharf. Granulated, supplies scarce.

Chlorine, Liquid.—£23 per ton, d/d in 16/17 cwt. drums (3-drum lots).

Chrometan.—Crystals, 5⅝d. per lb.

Chromic Acid.—1s. 7d. per lb., less 2½%, d/d U.K.

Citric Acid.—Controlled prices per lb., d/d buyers' premises. For 5 cwt. or over, anhydrous, 1s. 6¾d., other, 1s. 5d.; 1 to 5 cwt., anhydrous, 1s. 9d., other, 1s. 7d. Higher prices for smaller quantities.

Copper Carbonate.—MANCHESTER: £6 10s. to £6 12s. 6d. per cwt. d/d.

Copper Oxide.—Black, powdered, about £100 per ton.

Copper Sulphate.—£32 5s. per ton, f.o.b., less 2%, in 2 cwt. bags.

Cream of Tartar.—100 per cent., per cwt., from £13 17s. 6d. for 10-cwt. lots to £14 1s. per cwt. lots, d/d. Less than 1 cwt., 2s. 5½d. to 2s. 7½d. per lb. d/d.

Formaldehyde.—£27 to £28 10s. per ton in casks, according to quantity, d/d. MANCHESTER: £28.

Formic Acid.—85%, £54 per ton for ton lots, carriage paid.

Glycerine.—Chemically pure, double distilled 1260 s.g., in tins, £4 to £5 per cwt., according to quantity; in drums, £3 19s. 6d. Refined pale straw industrial, 5s. per cwt. less than chemically pure.

Hexamine.—Technical grade for commercial purposes, about 1s. 4d. per lb.; free-running crystals are quoted at 2s. 1d. to 2s. 3d. per lb.; carriage paid for bulk lots.

Hydrochloric Acid.—Spot, 7s. 6d. to 8s. 9d. per carboy d/d, according to purity, strength and locality.

Hydrofluoric Acid.—59/60%, about 1s. to 1s. 2d. per lb.

Hydrogen Peroxide.—11d. per lb. d/d, carboys extra and returnable.

Iodine.—Resublimed B.P., 10s. 4d. to 14s. 6d per lb., according to quantity.

Lactic Acid.—Pale tech., £60 per ton; dark tech., £53 per ton ex works; barrels returnable.

Lead Acetate.—White, 56s. to 58s. per cwt. according to quantity.

Lead Nitrate.—About £49 per ton d/d in casks. MANCHESTER: £51.

Lead, Red.—Basic prices, per ton: Genuine dry red lead, £60; orange lead, £72. Ground in oil: Red, £73; orange, £85 Ready-mixed lead paint: Red, £76; orange, £88.

Lead, White.—Dry English, in 8-cwt. casks, £72 10s. per ton. Ground in oil, English, in 5-cwt. casks, £83 10s. per ton.

Litharge.—1 to 2 tons, £44 10s. per ton.

Lithium Carbonate.—7s. 9d. per lb. net.

Magnesite.—Calcined, in bags, ex works, £18 15s. to £22 15s. per ton.

Magnesium Chloride—Solid (ex wharf), £22 per ton.

Magnesium Sulphate.—£12 to £14 per ton.

Mercuric Chloride.—Per lb., for 2-cwt lots, 8s. 5d.; for 7 to 28-lb. lots, 8s. 11d.

Mercurous Chloride.—10s. 1d. to 10s. 7d. per lb., according to quantity.

Mercury Sulphide, Red.—Per lb., from 10s. 3d. for ton lots and over to 10s. 7d. for lots of 7 to under 30 lb.

Methylated Spirit.—Industrial 66° O.P. 100 gals., 3s. 1½d. per gal.; pyridinised 64° O.P. 100 gal., 3s. 2½d. per gal.

Nitric Acid.—£24 to £26 per ton, ex works.

Oxalic Acid.—£85 5s. per ton for ton lots, spot, carriage paid, in 5-cwt. casks; smaller parcels would be dearer. MANCHESTER: £3 7s. 6d. per cwt.

Paraffin Wax.—Nominal.

Phosphorus.—Red, 3s. per lb. d/d; yellow, 1s. 10d. per lb. d/d.

Potash, Caustic.—Solid, £65 10s. per ton for 1-ton lots; flake, £76 per ton for 1-ton lots. Liquid, d/d, nominal.

Potassium Bichromate. — Crystals and granular, 7¾d. per lb.; ground, 8¾d. per lb., for not less than 6 cwt.; 1-cwt. lots, ¼d. per lb. extra.

Potassium Carbonate.—Calcined, 98/100%, £57 per ton for 5-ton lots, £57 10s. per ton for 1 to 5-ton lots, all ex store; hydrated, £51 per ton for 5-ton lots, £51 10s. for 1 to 5-ton lots.

Potassium Chlorate.—Imported powder and crystals, nominal

Potassium Iodide.—B.P., 8s. 8d. to 12s. per lb., according to quantity.

Potassium Nitrate.—Small granular crystals, 76s. per cwt. ex store, according to quantity.

Potassium Permanganate.—B.P, 1s. 8½d. per lb. for 1-cwt. lots; for 3 cwt. and upwards, 1s. 8d. per lb.; technical, £7 12s. to £8 6s. 3d. per cwt., according to quantity d/d.

Potassium Prussiate.—Yellow, nominal.

Salammoniac.—First lump, spot, £48 per ton; dog-tooth crystals, £50 per ton; medium, £48 10s. per ton; fine white crystals, £19 10s. per ton, in casks, ex store.

Salicylic Acid.—MANCHESTER: 1s. 7d. to 1s. 11d. per lb. d/d.

Soda, Caustic. — Solid 76/77%; spot, £16 7s. 6d. per ton d/d.

Sodium Acetate.—£42 per ton, ex wharf.

Sodium Bicarbonate.—Refined, spot, £11 per ton, in bags.

Sodium Bichromate.—Crystals, cake and powder, 6½d. per lb.; anhydrous, 7½d. per lb., net, d/d U.K. in 7-8 cwt. casks.

Sodium Bisulphite. — Powder, 60/62%, £19 10s. per ton d/d in 2-ton lots for home trade.

Sodium Carbonate Monohydrate.—£25 per ton d/d in minimum ton lots in 2 cwt. free bags.

Sodium Chlorate.—£36 to £45 per ton, nominal.

Sodium Hyposulphite.—Pea crystals (4-ton lots or more), per cwt. in kegs 24s. 3d., in bags 17s. 9d.; (ton lots) 25s. in kegs, 18s. 6d. in bags; commercial, 5-ton lots, £16 per ton carriage paid. Packing free.

Sodium Iodide.—B.P., for not less than 28 lb., 9s. 11d. per lb., for not less than 7 lb., 13s. 1d. per lb.

Sodium Metaphosphate (Calgon).—11d. per lb. d/d.

Sodium Metasilicate.—£16 10s. per ton, d/d U.K. in ton lots.

Sodium Nitrite.—£20 15s. per ton.

Sodium Percarbonate.—12½% available oxygen, £7 per cwt.

Sodium Phosphate.—Di-sodium, £22 per ton d/d for ton lots. Tri-sodium, £25 per ton d/d for ton lots.

Sodium Prussiate.—9d. to 9½d. per lb. ex store.

Sodium Silicate.—£6 to £11 per ton.

Sodium Sulphate (Glauber Salt).—£4 10s. per ton d/d.

Sodium Sulphate (Salt Cake).—Unground. Spot £4 11s. per ton d/d station in bulk. MANCHESTER: £4 12s. 6d. to £4 15s. per ton d/d station.

Sodium Sulphide. — Solid, 60/62%, spot, £19 2s. 6d. per ton, d/d, in drums; crystals, 30/32%, £12 7s. 6d. per ton, d/d, in casks.

Sodium Sulphite.—Anhydrous, £29 10s. per ton; pea crystals, £20 10s. per ton d/d station in kegs; commercial, £12 to £14 per ton d/d station in bags.

Sulphur.—Per ton for 4 tons or more, ground, £14 to £16 5s., according to fineness.

Sulphuric Acid.—168° Tw., £6 2s. 8d. to £7 2s. 8d. per ton; 140° Tw., arsenic-free, £4 11s. per ton; 140° Tw., arsenious, £4 3s. 6d. per ton. Quotations naked at sellers' works.

Tartaric Acid.—Per cwt., for 10 cwt. or more, £15 8s.; 5 to 10 cwt., £15 9s. 6d.; 2 to 5 cwt., £15 11s.; 1 to 2 cwt., £15 13s. Less than 1 cwt., 3s. 1d. to 3s. 3d. per lb. d/d, according to quantity.

Tin Oxide.—Nominal.

Zinc Oxide.—Maximum prices per ton for 2-ton lots, d/d; white seal, £45 15s.; green seal, £44 15s.; red seal, £43 5s.

Zinc Sulphate.—Tech., £20-£21 per ton, carriage paid, casks free.

Rubber Chemicals

Antimony Sulphide.—Golden, 1s. 5d. to 2s. 6d. per lb. Crimson, 2s. 2d. to 2s. 6d. per lb.

Arsenic Sulphide.—Yellow, 1s. 9d. per lb.

Barytes.—Best white bleached, £8 3s. 6d. per ton.

Cadmium Sulphide.—6s. to 6s. 6d. per lb.

Carbon Bisulphide.—£37 to £41 per ton, according to quality, in free returnable drums.

Carbon Black.—6d. to 8d. per lb., according to packing.

Carbon Tetrachloride.—£44 to £49 per ton, according to quantity.

Chromium Oxide.—Green, 2s ped lb.

India-rubber Substitutes.—White, 6 3/16d. to 10¼d. per lb.; dark, 6 3/16d. tc 6 15/16d. per lb.

Lithopone.—30%, £26 5s. per ton.

Mineral Black.—£7 10s. to £10 per ton.

Mineral Rubber, "Rupron."—£20 per ton.

Sulphur Chloride.—7d. per lb.

Vegetable Lamp Black.—£49 per ton.

Vermilion.—Pale or deep, 15s. 6d. per lb. for 7-lb. lots.

Plus 5% War Charge.

Nitrogen Fertilisers

Ammonium Phosphate.—Imported material, 11% nitrogen, 48% phosphoric acid, per ton d/d farmer's nearest station, £20 15s.

Ammonium Sulphate.—Per ton in 6-ton lots, d/d farmer's nearest station, in February, £10 0s. 6d., in March-June, £10 2s.

Calcium Cyanamide.—Nominal; supplies very scanty.

Concentrated Fertilisers.—Per ton d/d farmer's nearest station, I.C.I. No. 1 grade, in March, £14 18s. 6d.

"Nitro Chalk."—£9 14s. per ton in 6-ton lots, d/d farmer's nearest station.

Sodium Nitrate.—Chilean super-refined for 6-ton lots d/d nearest station, £15 15s. per ton; granulated, over 98%, £10 14s. per ton.

Coal Tar Products

Benzol.—Per gal. ex works: 90's, 2s. 6d.; pure, 2s. 8½d.; nitration grade, 2s. 10½d.

Carbolic Acid.—Crystals, 11¼d. per lb. Crude, 60's, 4s. 3d. Manchester: Crystals, 9½d. to 11¼d. per lb., d/d; crude, 4s. 3d., naked, at works.

Creosote.—Home trade, 6¼d. to 7d. per gal., f.o.r. maker's works. Manchester, 6¼d. to 9¾d. per gal.

Cresylic Acid.—Pale, 97%, 3s. 6d. per gal.; 99%, 4s. 2d.; 99.5/100%, 4s. 4d. American, duty free, 4s. 2d., naked at works. Manchester: Pale, 99/100%, 4s. 4d. per gal.

Naphtha.—Solvent, 90/160°, 2s. 10d. per gal. for 1000-gal. lots; heavy, 90/190°, 2s. 4d. per gal. for 1000-gal. lots, d/d. Drums extra; higher prices for smaller lots. Controlled prices.

Naphthalene.—Crude, ton lots, in sellers' bags, £7 4s. to £10 13s. per ton, according to m.p.; hot-pressed, £11 10s. to £12 14s. per ton, in bulk ex works; purified crystals, £25 15s. to £28 15s. per ton. Controlled prices.

Pitch.—Medium, soft, home trade, 70s. per ton f.o.r. suppliers' works; export trade, 95s. per ton f.o.b. suppliers' port. Manchester: 75s. 6d. to 77s. 6d. f.o.r.

Pyridine.—90/140°, 18s. per gal.; 90/160°, 13s. Manchester: 14s. 6d. to 18s. 6d. per gal.

Toluol.—Pure, 3s. 0½d. per gal.; 90's, 2s. 4½d. per gal. Manchester: Pure, 3s. 1d. per gal. naked.

Xylol.—For 1000-gal. lots, 3s. 3½d. to 3s. 6d. per gal., according to grade, d/d.

Wood Distillation Products

Calcium Acetate.—Brown, £21 per ton; grey, £24. Manchester: Grey, £24 to £25 per ton.

Methyl Acetone.—40/50%, £56 per ton.

Wood Creosote.—Unrefined, about 2s. per gal., according to boiling range.

Wood Naphtha, Miscible.—4s. 6d. to 5s. 6d. per gal.; solvent, 5s. 6d. per gal.

Wood Tar.—£5 per ton.

Intermediates and Dyes (Prices Nominal)

***m*-Cresol** 98/100%.—Nominal.

***o*-Cresol** 30/31° C.—Nominal.

***p*-Cresol** 34/35° C.—Nominal.

Dichloraniline.—2s. 8½d. per lb.

Dinitrobenzene.—8½d. per lb.

Dinitrotoluene.—48/50° C., 9½d. per lb; 66/68° C., 1s.

***p*-Nitraniline.**—2s. 5d. per lb.

Nitrobenzene.—Spot, 5½d. per lb. in 90-gal. drums, drums extra, 1-ton lots d/d buyer's works.

Nitronaphthalene.—1s. 2d. per lb.; P.G., 1s. 0½d. per lb.

***o*-Toluidine.**—1s. per lb., in 8/10 cwt. drums, drums extra.

***p*-Toluidine.**—2s. 2d. per lb., in casks.

***m*-Xylidine Acetate.**—4s. 5d. per lb., 100%.

Latest Oil Prices

London.—April 24.—For the period ending May 5 (April 27 for refined oils), per ton, naked, ex mill, works or refinery, and subject to additional charges according to package: Linseed Oil, crude, £65. Rapeseed Oil, crude, £91. Cottonseed Oil, crude, £52 2s. 6d.: washed, £55 5s.; refined edible, £57; refined deodorised, £58. Coconut Oil, crude, £49; refined deodorised, £49; refined hardened deodorised, £53. Palm Kernel Oil, crude, £48 10s.; refined deodorised, £49; refined hardened deodorised, £53. Palm Oil, refined deodorised, £53; refined hardened deodorised, £58. Groundnut Oil, crude, £56 10s.; refined deodorised, £58; refined hardened deodorised, £62. Whale Oil, crude hardened, 42 deg., £51 10s.; refined hardened, 46/48 deg., £52 10s. Acid Oils: Groundnut, £40; soya, £38; coconut and palm-kernel, £43 10s. Rosin, 30s. 6d. to 45s. per cwt. ex store, according to grade. Turpentine, American, 87s. per cwt. in drums or barrels, as imported (controlled price).

Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted may be obtained from the Patent Office, Southampton Buildings, London, W.C.2., at 1s. each. Numbers given under "Applications for Patents" are for reference in all correspondence up to acceptance of the complete specification.

Applications for Patents

Drum closures, etc.—Metal Containers, Ltd., and E. W. Cross. 7739.

Polymers.—N.V. de Bataafsche Petroleum Maatschappij. (Holland, May 2, '45.) 8021.

Asphaltic bitumens.—N.V. de Bataafsche Petroleum Maatschappij (Holland, June 16, '44.) 8022.

Arsenic.—National Smelting Co., Ltd., and L. J. Derham. 7618.

Zinc condensation.—National Smelting Co., Ltd., and S. Robson. 7619, 7620, 7621.

Plastic material.—C. Nicolle. (France, Feb. 1, '44.) 7667 (France, Aug. 4, '44.) 7668.

Plastic material cements.—H. Norman. 8056.

Ammonia production.—S. Odelhög. (Sweden, March 2, '45.) 8389.

Quaternary ammonium compounds.—Parke, Davis & Co. (United States, Jan 11, '46.) 8033, 8034, 8035.

Purification of liquids.—Paterson Engineering Co., Ltd., and W. Smalley. 7999.

Dyeing pile fabrics.—R. H. Sennett, and Imperial Chemical Industries, Ltd. 7840

Silicon esters.—W. E. Smith, and C. Shaw. 8078.

Penicillin.—Soc. des Usines Chimiques Rhône-Poulenc. (France, April 17, '45.) 7691.

Sulphonamides.—Soc. des Usines Chimiques Rhône-Poulenc. (France, April 11, '45). 8236.

Styrenes.—Standard Telephones & Cables, Ltd. (United States, June 4, '45.) 8186.

Styrene composition.—Standard Telephones & Cables, Ltd. (United Staes, May 21, '45.) 8187.

Treatment of metal flakes.—A. H. Stevens (Metals Disintegrating Co., Inc.) 7822.

Anthraquinone dyestuffs.—W. W. Tatum, and Imperial Chemical Industries, Ltd. 8309.

Polymerisation of 2-vinyl thiazoles.—United States Rubber Co. (United States, June 5, '45.) 8091.

Polydihydrotetrazines.—A. Abbey. (N.V. Algemeene Kunstzijde Unie.) 9207.

Dihydrotetrazine products.—A. Abbey. (N.V. Algemeene Kunstzijde Unie.) 3208.

High molecular condensation products.—A. Abbey. (N.V. Algemeene Kunstzijde Unie.) 9209.

Polyphosphates.—Albright & Wilson, Ltd., and G. Inglis. 8896.

Resins.—American Cyanamid Co. (United States, July 17, '45.) 8551.

Organic materials.—C. Arnold. (Standard Oil Development Co.). 8548.

Dyestuffs.—W. F. Beech, M. Mendoza, and Imperial Chemical Industries, Ltd. 8469.

Polymeric substances.—W. K. Birtwistle. 8945.

Cast Iron.—British Cast Iron Research Association, and H. Morrogh. 9093.

Cellulose derivatives.—British Celanese, Ltd. (United States, March 30, '45.) 8937.

Cellulosic sheets.—British Cellophane, Ltd. (United States, March 27, '45.) 9213.

Polymeric materials.—J. S. Byers, J. C. Swallow, and Imperial Chemical Industries, Ltd. 8969.

Polymeric materials.—J. S. Byers, J. C. Swallow, J. M. Walter, and Imperial Chemical Industries, Ltd. 8968.

Carbon-bisulphide storage.—D. Bywater. 8817.

Abrasive articles.—Carborundum Co., (United States, April 6, '45.) 8680.

Piperidyl ketones.—Ciba, Ltd. (Switzerland, April 10, '45.) 8785.

Piperidyl ketones.—Ciba, Ltd. (Switzerland, March 5, '46.) (Cognate with 8785.) 8786.

Aqueous wax emulsions.—E. G. Cockbain, and Imperial Chemical Industries, Ltd. 8740.

Metal tubes.—Cie. Gen. du Duralumin et du Cuivre. (France, Feb. 19, '44.) 8836.

Fluid pressure apparatus.—Cox Patent Rotary Pump, Ltd., and A. F. Cox. 9121.

Insecticides.—N. V. Chemische Fabriek Rids. (Holland, Sept. 7, '42.) 8448.

Carbon electrodes.—Det Norske Aktieselskab for Elektrokemisk Industri. (Norway, April 22, '44.) 8803.

Electric furnaces.—Det Norske Aktieselskab for Elektrokemisk Industri. (Norway, June 16, '44.) 8804.

Alcohol drying processes.—Distillers Co., Ltd., and G. H. Twigg. 8707.

Plastic compositions.—Distillers Co., Ltd., C. A. Brighton, and J. J. P. Staudinger. 8706.

Polystyrenes.—Distillers Co., Ltd., H. M. Hutchinson, J. J. P. Staudinger. 8705.

Distillation process.—Distillation Products, Inc. (United States, April 5, '45.) 8724.

Catalysts.—E.I. Du Pont de Nemours & Co. (United States, March 21, '45.) 8738.

Herbicides.—E.I. Du Pont de Nemours & Co. (United States, March 22, '45.) 8976.

Hydrolysed interpolymers.—E.I. Du Pont de Nemours & Co., and C. A. Sperati. 8472.

Sewage treatment.—H. G. C. Fairweather. (Guggenheim Bros.) 8957.

Organic materials.—J. P. Fraser. 9008.

Pressure vessels.—W. J. Fraser & Co., Ltd., and F. Peel. 8579.

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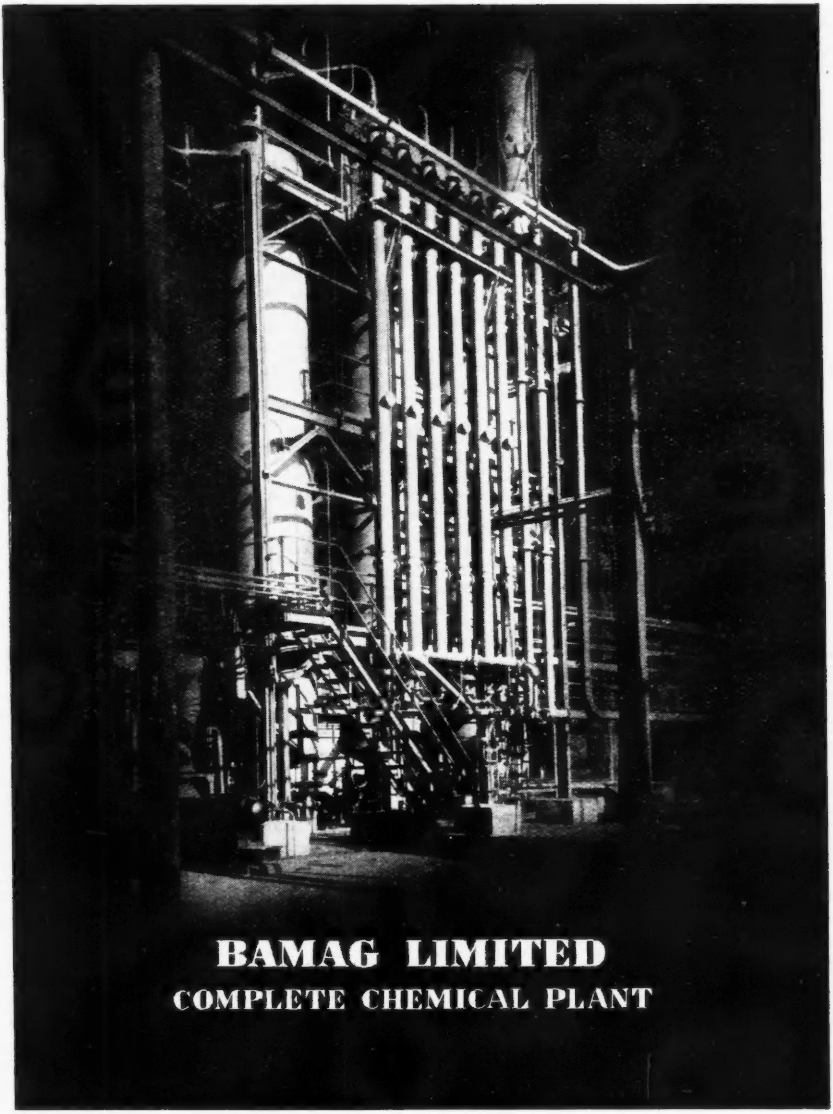
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Cholesterol.—Glaxo Laboratories, Ltd., A. E. Bide, R. J. Nicholls, and P. A. Wilkinson. 9147, 9148.

Pesticides.—B. F. Goodrich Co. (United States, April 2, '45.) 8550.

Pyrometers.—J. Gordon & Co., Ltd., (United States, July 24, '45.) 8540.

Caustic alkalis.—A. G. M. Hedley, F. M. Joscelyne, J. C. H. McEntee, and Imperial Chemical Industries, Ltd. 9116.

Synthetic resins.—E. Hene. 8699.

Furo-imidazoles.—K. Hofmann. (United States, April 4, '45.) 9152.

Insecticides.—R. M. Hughes. (J. R. Geigy A.G.) 8646.

Insecticides.—J. Hyman. (United States, July 25, '45.) 8475.

Complete Specifications Open to Public Inspection

Casting of metal bars, rods, sheets, and the like.—H. E. Foster. Sept. 13, 1944. 23164/45.

Diazotype layer for neutral black shades. Sept. 14, 1944. 24538/44.

Stabilised silver halide emulsions.—General Aniline & Film Corporation. Sept. 16, 1944. 24539/44.

Purification of cellulosic materials.—Hercules Powder Co. Sept. 16. 1944. 18556/45.

Self-agitating metallurgical salt baths.—A. de F. Holden. Sept. 14, 1944. 21513/45.

Vulcanisation of polymers.—Imperial Chemical Industries, Ltd. Sept. 16, 1944. 23743/45, 23744/45.

Pressure-sensitive adhesives.—Johnson & Johnson (Great Britain), Ltd. Sept. 14, 1944. 22764/45.

Device for the continuous dialysis of liquids in counter-current.—G. W. van B. Kooy. Sept. 7, 1942. 1697/45.

Fatty α, α′-dialkyl ethylenic acids.—Laboratoires Français Chimiotherapie. Aug. 4, 1944. 1263/46.

Producing aminoalkanes.—E. Lilly & Co. Sept. 13, 1944. 23418/45.

Electrodeposition.—P. R. Mallory & Co., Inc. Sept. 14, 1944. 19659/45.

Plasticising compositions.—Mathieson Alkali Works. Oct. 3, 1942. 16730/43.

Distillation of heat-polymerisable materials.—Mathieson Alkali Works. Dec 1, 1942. 18251/43.

Chemical compounds and processes of preparing same.—Merck & Co., Inc. Sept. 16, 1944. 22781-92/45.

Production of nickel or cobalt in the form of flake.—Mond Nickel Co., Ltd. May 17, 1943. 7731/44.

Ascorbic acid from ketogulonic acid esters. N.V. Bataafsche Petroleum Mij. Jan. 7, 1944. 856/46.

Manufacture of co-polymers from vinyl compounds and vinylidene compounds by polymerisation in emulsion.—N.V. Bataafsche Petroleum Mij. Dec. 10, 1942. (Cognate application 858//46.) 857/46.

Manufacture of peroxide compounds by oxidation of amalgams.—N.V. Koninklijke Nederlandsche Zoutindustrie. April 21, 44. 1680/46.

Process for forming water-insoluble layers from colloids on supports or substrata and for making dry preparations for use in said process.—N.V. W. A. Scholten's Chemische Fabrieken. April 25, 1941. 691/46.

Dry starch preparations soluble in cold water.—N.V. W. A. Scholten's Chemische Fabrieken. April 25, 1941. 928/46.

Condensation products and polymerisation products thereof.—Pittsburgh Plate Glass Co. June 16, 41. 4560/42.

Filter.—A. E. M. Raulais. Sept. 14, 1944. 23367/45.

Production of sodium bicarbonate and ammonium chloride.—W. Reinders. Jan. 14, 42. 1321/46.

Production of isoprene by distillation of rubber.—Rubber-Stichting. April 6, 1943. (Cognate application 1285/46.) 1285/46.

Device for pyrolysis.—Rubber-Stichting. Dec. 6, 1943. 1286/46.

Manufacture of isoprene.—Rubber-Stichting. Jan. 8, 1944. 1287/46.

Waterproof coatings.—Shawinigan Chemicals, Ltd. Nov. 4, 1942. 9506/43.

Controlled oxidation of alicyclic hydrocarbons and of their derivatives.—Shell Development Co. Jan. 30, 1943. 1376/44.

Metal-forming lubricant.—Shell Development Co. Sept. 18, 1944. 19551/45.

Separation process.—Shell Development Co. Sept. 16, 1944. 21585/45.

Preparing mercury salts adapted for use as toxic paints or coats.—Soc. Anon. Vitex. —March 6, 1944. 682/46.

Preparing metal salts starting from resinic acids, fatty acids, terpenes, and their derivatives for use in the preparation of paints and varnishes.—Soc. Anon. Vitex. March 6, 1944. 683/46.

Producing cellulose starting from vegetable fibrous material.—Soc. Auxiliare des Industries Cellulosiques.—Sept. 18, 1944. 19643/45.

Measuring the calorific power of a gas.—Soc. Français des Regulateurs Universels Arca. Oct. 26, 1943. 1682/46.

Compositions having a basis of superpolyamides.—Soc. Rhodiaceta. April 7, 1944. 804/46.

Process and arrangement for synthesis of tetrachlorethane.—Solvay & Cie. March 15, 1944. 734/46.

Avoiding incrustations.—Solvay & Cie. July 24, 1943. 1096/46.

Transference of liquefied gases.—Solvay & Cie. June 8, 1942. 1292/46.

Alkylation of olefins with isoparaffins.—Standard Oil Development Co. Aug. 2, 1941. 8799/42.

Separation of solid or liquid particles from flowing gas or vapour.—A.G. Brown, Boveri & Cie. (Sept. 6, 1944.) 23045/45.

Substituted butanols.—British Celanese, Ltd. (Sept. 21, 1944.) 23973/45.

Polymers and copolymers of acenaphthylene. (Sept. 26, 1944.) 24441/45.

Vinyl copolymer and process for its production.—Carbide & Carbon Chemicals Corporation. (Sept. 20, 1944.) (Cognate application 18608/45.) 18607/45.

Vat dyestuffs.—Ciba, Ltd. (Sept. 25, 1944.) (Cognate application 24688/45.) 24687/45.

Concentration of vitamin A esters.—Distillation Products, Inc. (Sept. 22, 1944.) 15804/45.

Manufacture of coatings and shaped articles from synthetic linear polyamides. E.I. Du Pont de Nemours & Co. June 3, 1942. 8826/43.

Polyhydroxy compounds.—E.I. Du Pont de Nemours & Co. Oct. 28, 1942. 17704/43.

Porous article consisting essentially of polymers of tetrafluorethylene. Sept. 20, 1944. 24196/45.

Chemical compounds.—E.I. Du Pont de Nemours & Co. Sept. 25, 1944. 24667/45.

Chlorinated rubber adhesives.—Firestone Tyre & Rubber Co. Sept. 20, 1944. 27713/45.

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